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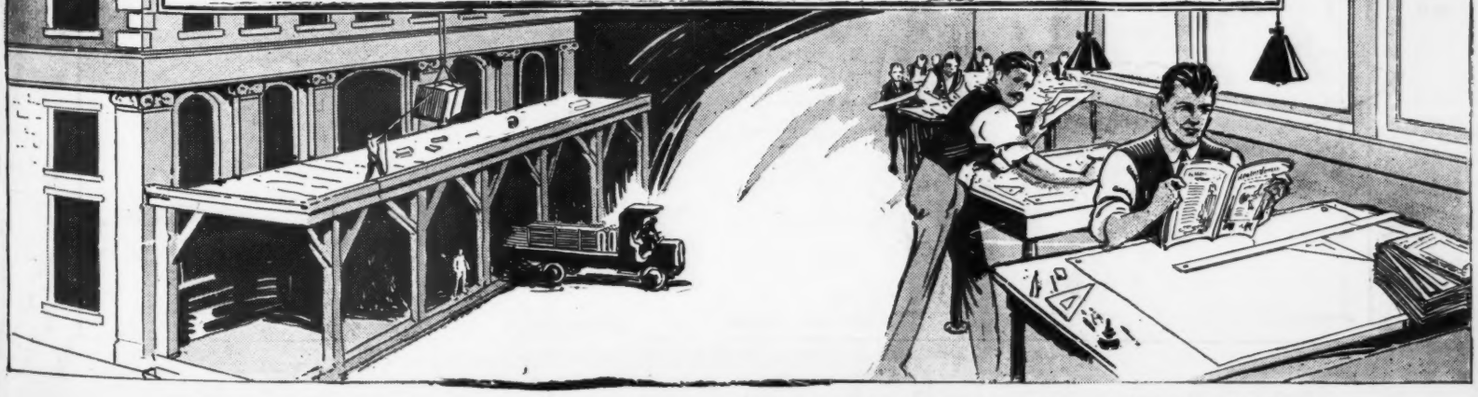

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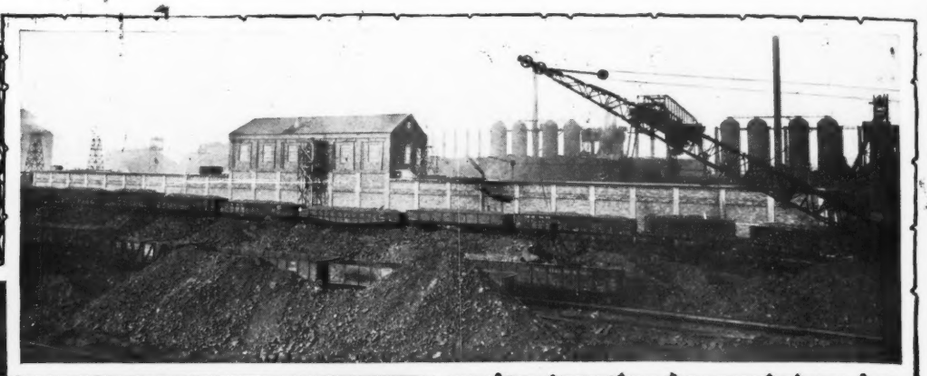
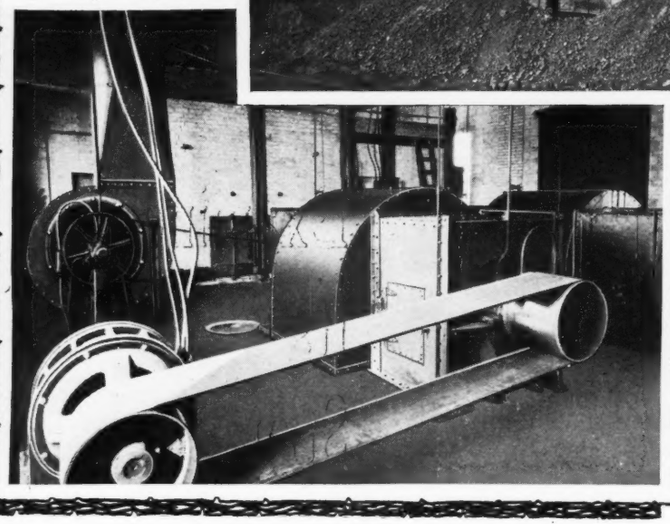
Thaw House for Frozen Coal at Youngstown Sheet & Tube Company, Youngstown, Ohio.





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ELIMINATION OF NOISES IN HEATING AND VENTILATING SYSTEMS

Notes on the Cause, Effect and Prevention of Mechanical, Air and Water Hammer Vibrations

I

NOISES in heating and ventilating systems are matters which may be overcome by careful design. The cause of these and the remedy is better understood in present days and while doubtless existing in many an industrial plant where they are not particularly objectionable, their existence is no longer prevalent in such buildings as churches, schools, libraries, theatres, hospitals, office or other buildings where quietness of operation is essential.

Such noises include water hammer in various forms, whistling of air valves and reducing valves, or steam in pipes, the operation of steam in traps, vibrations from fans, motors, engines, etc., roaring of air in ducts, and the steam in piping as affected by pulsations from engines. Some of these noises can be minimized while others can be eliminated by doing without the device itself, as in the case of air valves which are not required on vapor or vacuum heating systems.

The psychology of water hammer has long been portrayed in cartoons where the janitor's pounding on a cold steam pipe satisfies the tenants, who, so often accustomed to noise as a part of the heating system, are led to believe that its companion, heat, will soon follow. However, this should remain as a thing of the past, since the cause of water hammer is now well understood and may be eliminated in the design by provision for proper pitch, the use of eccentric fittings where reductions in the size of pipe are made, prevention of flow in opposition, and the avoidance of pockets.

CAUSE OF WATER HAMMER.

Water hammer has a characteristic sharp metallic knock which may be likened to the beating of a sledge hammer upon some metal surface. This knocking and vibration is more active in long steam and dry return pipes and is caused by steam rapidly condensing in contact with large quantities of water at a low temperature. When suddenly condensed at atmospheric pressure, it occupies 1/1600 of its original volume, so that a vacuum is formed in the remaining space, creating severe concussions as the bodies of water come together. It is peculiarly violent when admitted to a cold vacuous pipe since there is no air to cushion the blow, but even air will not ordinarily eliminate its destructive force. The condensed steam (water), which is practically incompressible, is forced ahead like a solid body of equal weight by the steam rushing into the vacuous spaces with such high velocity

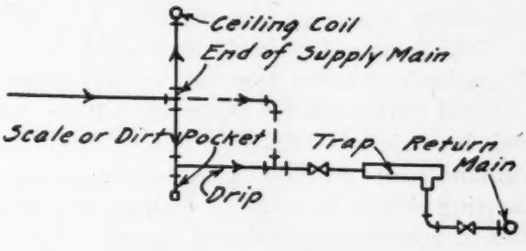


FIG. 1—HOW TO DRIP END OF MAIN TO PREVENT CONDENSATION FROM ENTERING CEILING PIPE COIL.

that it slams the water against bends, the walls of a tee or short-turn elbow, closed valves, the end of a pipe, etc. This terrific force or shock causes joints to leak, threads to loosen, and pipes to fracture. The action occurs again and again in rapid succession, due to the resulting mixture of steam and water, and is more noticeable in a cold system when quickly started up and forced. The remedy in this case is slow admission, preferably through a by-pass valve, opening and closing if necessary, until all pipes and radiating surfaces are brought to an even temperature.

DIFFERENT REMEDIES FOR WATER HAMMER.

From the previous remarks, it will be seen that the remedy for water hammer is to prevent condensation within the pipes, so far as possible, and keep such condensate at a minimum of contact with steam at a higher temperature. These are matters which may be accomplished by good drainage, proper connections and dripping, elimination of short circuiting, covering of pipes, prevention of priming at the boiler, and the correct use of sealed returns. Condensation in steam pipes is often attributed to boilers delivering wet steam, though it is more often an evidence of inferior design and arrangement of piping, and may cause considerable unnecessary repairs in the plant operation. Where impossible to keep the piping wholly free from condensate, the conditions can at least be improved so as to materially reduce the amount. Proper drainage is essential, using returns sealed by siphon loops, with pipes of good pitch and ample size, particularly in the one-pipe system which is more frequently the offender in the matter of noise.

COVERING OF PIPES TO REDUCE CONDENSATION.

Though water may be found in the system from various causes, such as that occurring even with the best of covering, and a certain amount of moisture is unavoidably carried over by steam from the boilers; it is more often caused by insufficient or poor grade of covering with resulting waste of heat and excess condensation. Bare pipe will radiate about 3 B. T. U. per hour per square foot of surface per degree of temperature difference, a figure which may be reduced to 0.35 B. T. U. by a good insulation of 1-1/2-in. thickness. This loss of heat also depends upon the size and position of the pipe, whether vertical or horizontal, the velocity and temperature of the steam, the kind of surface and the velocity and temperature of the air currents to which it is exposed. In boiler rooms where steam is distributed at high pressure, 2 in. of 85% magnesia should be used on main steam lines, engine and boiler branches. Other piping may be covered only 1 in. in thickness, but all surfaces should be covered, including flanges, valve bodies, fittings and steam specialities, such as separators.

Covering should be installed with considerable care so that it is evenly applied and secured so as not to be affected by vibrations of piping. If the covering is of a granular of fibrous construction, it will shift and create an excess of material along the bottom of the pipe, and if allowed to become moist or wet, its efficiency will be reduced.

DETERMINATION OF PIPE SIZES AND VELOCITIES TO SECURE PROPER DRAINAGE.

In the determination of pipe sizes, certain factors should be considered, such as radiation from the pipes, the velocity of steam within them, or preferably the allowed pressure drop which the installation permits. For example, a system in which the drop in pressure can be made 4 lbs. will require smaller pipe sizes than the same job designed for a 2-lb. drop, since the lesser drop requires larger size pipe to reduce the friction to the required amount. The friction in a pipe when steam is moving at a velocity of 100 ft. per second causes a reduction in pressure of about 1½ lbs. in 100 ft., a velocity of 50 ft. per second causes about one-fourth as much, and a velocity of 25 ft. about one-sixteenth as much.

It is not desirable to restrict the size of piping to the extent that an increase in velocity results in water hammer and a decrease in efficiency. On the other hand, too large a size results in increased expenditure for larger sizes of pipe, valves, fittings, covering and supports. Furthermore, radiating surfaces are increased, and thus the possible condensation.

The steam may travel through the pipes at different velocities, depending upon the pressure and purpose for which the steam is conveyed. In a one-pipe system, with pipes 2-in. and under, 10 ft. per second should not be exceeded, and in pipes 2-in. to 4-in., 15 ft. per second is reasonable; while in larger pipes, the velocity may be as high as 30 ft. per second. In two-pipe work, in pipes 2-in. and less, the velocity may be 15 ft. per second, while in pipes 2 to 4-in., 25 ft. per second may be used, and in larger pipes, 40 to 50 ft. per second. In large heating systems, such as central plant systems with large size pipes, these velocities may be materially increased, the velocity in pipes 6 in. and larger, being as high as 100 ft. per second.

All of the above refers to low-pressure heating work. In steam engine connections, it is customary to assume 75 to 100 ft. per second, and in the exhaust steam mains from 75 to 150 ft. per second. Where steam is carried at high pressures, as is sometimes the case in central heating systems, the velocity may sometimes be as high as 150 ft. per second.

Increasing the size of drips and return piping will often remedy a condition of poor circulation as caused by excessive velocities. Very often a high velocity will carry water beyond the drip point so that it is desirable to extend drips for a short distance the full size of the steam main and then reduce to smaller size. It is also a good practice to run the steam main past the last radiator connection before dripping as shown in Fig. 1, in which the proper method is indicated by dotted lines, otherwise the condensation may be lifted by the pressure and velocity of the steam up and into the ceiling coil. The dotted portion should be full size of the steam main and carried 2 ft. beyond the connection to the coil before dripping.

Radiator connections in the one-pipe steam heating system are necessarily limited in pitch, so that high velocities are then particularly detrimental and are apt to prevent the return of condensation against the current of steam. This produces water hammer, and is more noticeable when the system is started up, or a radiator turned on.

Excess velocities are also objectionable in a two-

pipe system and may cause a reduction of steam within a radiator so that it will draw from the return end, thus preventing air removal and drainage. Pipe sizes should, therefore, be large enough to make the radiators highly efficient through good air and water removal, while velocities in excess of 14 ft. per second should not be used, since higher velocities will prevent condensation from draining back in pipes pitched against the flow of steam. Such pipes should be increased in size, or the velocity of steam decreased. Condensation will also be carried up in one pipe up-feed steam risers if the velocity exceeds 30 ft. per second.

SIZING RISERS FOR CERTAIN CONDITIONS OF DRAINAGE.

Where offsets in risers occur, the size of the pipe should be increased one size to offset the effect of the water of condensation flowing down through the pipe, and to prevent disturbance or noise. Runouts from risers to radiators should be of ample size and always pitched back to the riser, otherwise condensation will be trapped at the rise to the radiator and be the cause of water hammer.

Branches 5 ft. or more from main to riser should be made one size larger than the riser, and branches to radiators over 5 ft. long should be made one size larger than radiator connections.

In the case of overhead systems with down-feed risers, it is not advisable to reduce the size of the riser as the radiator branches are taken off. Such reductions when made at the point of radiator connections, are apt to cause water in the riser from the radiator above (together with the condensation in the riser itself) to run into the radiator, causing noise or water hammer. The lowest radiators must necessarily

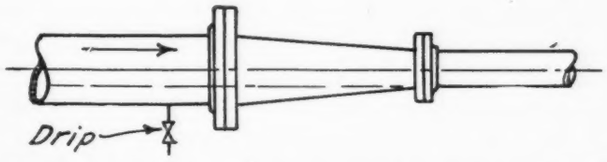


FIG. 2—METHOD OF DRIPPING POCKET CAUSED BY REDUCING FITTINGS.

be connected to the riser which should continue down into the basement full size for at least 18 in. below the lowest connection, so that the water from the radiator above will not be carried into the lowest radiators. The foot of all risers should be dripped into the return main.

PROPER PITCH OF PIPES TO AVOID ACCUMULATIONS OF WATER.

It will be seen from the previous remarks that the size of steam mains and the velocities within them are also very much affected by the pitch of the pipes and whether they are dripped with or against the flow of steam.

In general, the steam main of a steam heating apparatus is carried as high as possible in the basement or cellar and is then pitched downward away from the boiler. This is done to prevent the condensation from flowing in an opposite direction to the steam. Only where the pipes do not exceed 20 or 30 ft. in length should the steam and condensation be allowed to flow in opposite directions. In such cases, the pipes should be made slightly larger, with drips at a number of points. The pitch of the pipes should also be increased, otherwise water will accumlulate until it is finally picked up by the steam and carried along as a slug, causing water hammer.

With a sufficient number of drips taken from the steam main, the steam pipes may be pitched in either direction. In the case of the return pipes in the steam system, the pitch must always be downward in the direction of the flow of the condensation. The pitch of steam mains should be about 1 in. in each 12 ft. of pipe, but in large systems may be as small as 1 in. in 10 ft. of pipe, if the piping is carefully graded. In dry return systems, the return pipes should pitch a little more than in wet return systems.

KEEPING THE FLOW OF STEAM AND CONDENSATION IN THE SAME DIRECTION BY USING DOWN-FEED SYSTEMS.

It sometimes happens that headroom in the basement is valuable, or the ceiling is low so that the steam main having but a short rise would lift water from the boiler, or again the steam main through the necessity of maintaining the proper grade would be below the water line of the boiler. In such cases, the Mills overhead or down-feed system is more particularly adaptable, being simple in construction and very positive in the circulation of the heating medium.

In the Mills system, one large riser is carried from the top of the boiler directly to the attic or ceiling of the top story, and from this point a distributing main is carried around the top of the building, always pitching down in the direction of the down-feed risers.

One advantage of this method of distribution is that the steam and condensation both flow in the same direction, consequently the velocities are higher and pipe sizes may be somewhat reduced.

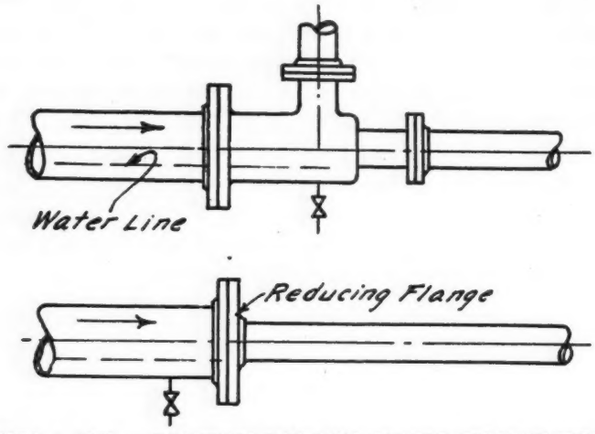
POCKETS OF TRAPS AS DRAINED BY DRIPS OR DRIP POCKETS.

An essential factor in particular with modern high-pressure steam mains of boiler and engine rooms, is the proper alignment of all pipes, but it is more important that no traps or pockets exist at any point in the system, such as those formed where taper reducers are used, or reductions in the size of pipe are made. Eccentric fittings may be used or lines dripped at such points with drain pipes of ample size, (see Figs. 2, 3 and 4). The difficulty may also be overcome by the use of drip pockets using a reducing tee looking down, or if a connection is to be taken from the top, a cross; to either of which a drip pocket is attached.

To properly drain high-pressure steam mains, a drip pocket should be attached to same, at least every 75 ft. The use of these pockets is more advisable than

the tapping of a small pipe connection in the bottom of fittings for the purpose of drainage, since the condensation will in most cases be carried at high speed over or past such small openings. It must be remembered that in well-proportioned high pressure steam mains the velocity is about 100 ft. per second and that such small drips cannot take care of large "slugs" or bodies of water, if the boilers should prime.

Drip pockets are usually the full size of the pipe, up to 12 in. and this provides an opening so large



FIGS. 3 AND 4—DRIPPING POCKETS CAUSED BY DIFFERENT REDUCING FITTINGS.

that there is no possibility of the water being carried past them. Such pockets are usually fitted with chain water gauges, so that the gauge may be closed quickly from the floor when the glass breaks, without danger of scalding the operator. These water glasses show the amount of condensation in the pocket and if the steam trap is working properly.

Drip pockets also serve as a trap or collector of foreign substances. In newly installed piping and boiler equipment, there is always a large amount of dirt, iron chips, loose boiler rivets, etc., which are blown through the main steam line and lodge under

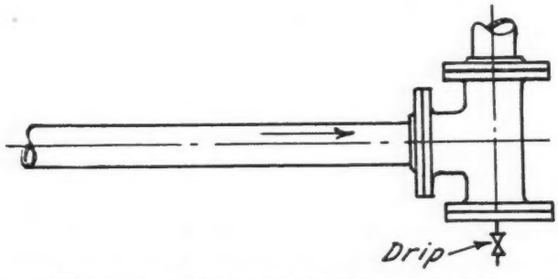


FIG. 5—METHOD OF DRIPPING A RISER.

stop valve seats, fill up the jets of injectors, and eventually land in the steam engine cylinders, scoring and cutting them so badly that in some cases they have to be renewed.

Whenever a rise is necessary, and wherever low points are formed, drips should be provided or drip pockets connected at the lowest point before the pipe starts to rise, as shown in Figs. 5 and 6. All main headers and all important branches should end in a drop leg and each drop leg should be connected to the return system. Branch lines should be connected from the top of the main header and not from the bottom. Branch pipes of large size, or if they can be shut off by valves, should have separate drains and no main steam pipe should drain only through such branch lines.

If a stop valve is necessarily installed in a vertical pipe and closed, in particular in a boiler lead to main steam header, it will collect water in considerable quantities over the valve seat. A drip tapped into the body of the valve just above the valve seat will relieve the water, but care must be taken to see that the drain valve is opened before opening the valve on the steam pipe, otherwise an accident may occur. A better practice is to automatically drain the pipe by connecting the drip to a trap, always remembering that drain pipes, such as those tapped into a boiler lead between two valves, should of course be with visible discharge outlet. Another remedy for this condition is

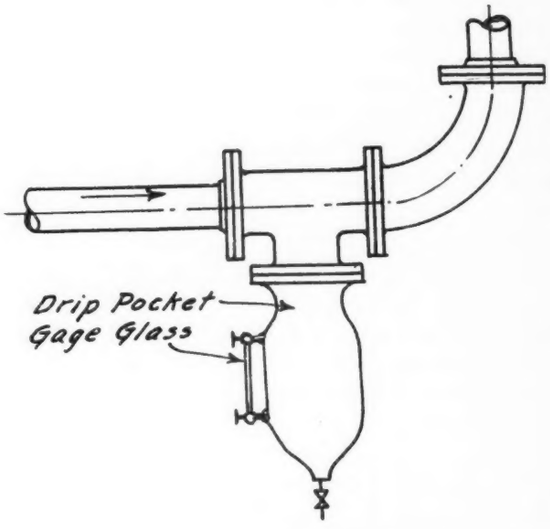


FIG. 6—APPLICATION OF DRIP POCKET TO A RISER.

to use an angle stop valve at the top of the vertical pipe and to pitch the horizontal pipe from it to the main, so that the condensation will drain to the latter.

IMPORTANCE OF HOLDING PIPES FIRMLY IN PLACE.

Pipes should be held firmly in place and prevented from sagging by using suitable hangers located at proper points. Flow pipes should be kept not less than 4 ft. from the outside wall so as to provide for expansion of mains and risers without causing pockets or putting excessive strains on the threads or fittings.

Gate valves should be given preference over globe valves, as the latter, due to their interior web or diaphragm which forms an integral part of a globe valve, impede the free drainage of the pipe and retard the condensation until the cross-area of the pipe is about half filled. If necessarily used, they should never be set vertically on horizontal pipes, but should be turned through an angle of 90° so as to lie on

their sides. In this position, they will retain less condensation.

To avoid water pockets, fittings 14-in. and larger usually have an internal diameter 3/4 in. less than the sides given in a catalog, thus conforming to the inside diameter of standard large outside diameter pipe which is 3/8 in. thick. Low-pressure copper expansion joints of the diaphragm type, when installed in a horizontal position, should be provided with a drain connection.

By means of all these various methods, pockets are eliminated and thus the amount of condensation re-

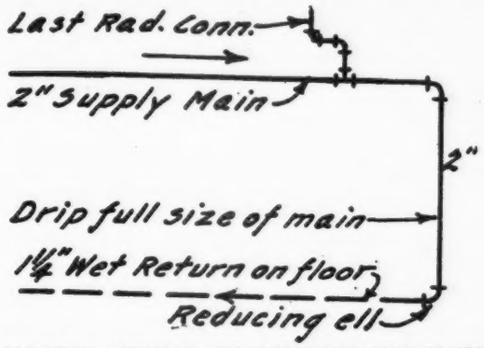


FIG. 7—CORRECT METHOD OF DRIPPING STEAM MAIN IN A ONE-PIPE SYSTEM.

duced, and this in turn does away with the additional condensation caused by steam coming into contact with water at a cooler temperature.

AVOIDING AGITATION OF THE WATER IN DRAWING OFF OF CONDENSATE.

It may appear in draining piping that all water has been drawn off, but if there is air binding at any point, water will be retained. In the operation of drawing-off, to avoid agitation of the water, all steam valves should first be closed before opening large drain valves. The remaining pressure may be insufficient to thoroughly drain the piping system, in which case the steam valve or by-pass valve should be cracked and then immediately closed, repeating the process as often as possible. Check valves should be installed in drain pipes to prevent steam from entering any part of the system which has been valved off.

PROPER DRAINAGE OF ONE-PIPE STEAM HEATING SYSTEMS TO AVOID WATER HAMMER.

In the one-pipe heating system, the steam is conveyed to and the condensation from the radiators, in the same branch and risers. It is therefore necessary to use larger pipe than is required in two-pipe work. The condensation in the risers will flow downward, and will have a tendency to cling to the inside surface of the pipe, while the steam will travel upward inside this cylinder of water. In the horizontal pipes the steam flows along the top, while the water flows at the bottom of the pipe, each in an opposite direction, which is, of course, not the ideal. The end of the radiator admitting steam should be lowest, so that the condensation will flow back freely, otherwise water hammer will result. As a general rule, the smaller the quantity of water flowing, the less will be the trouble resulting therefrom.

The method of dripping a condition sometimes varies with the individual, but in general Fig. 7 represents the practice of draining a one-pipe system having a wet return. The supply main should be run full size at least 1 ft. beyond the last radiator connection before dripping. If the runs are very short, or if pipe sizes are materially increased, then the mains may be pitched back to the boiler and dripped close to the same.

Supply runouts from the steam main to the risers or radiators should be inclined down from the radiator or riser to the main at 45° as shown in Fig. 8. This method allows the condensation to flow down along the bottom of the runout without obstructing the flow of the steam in the main as occurs when the runout is otherwise arranged (Fig. 9), with the condensation cutting through the main steam flow.

In next month's issue additional causes of water hammer and their prevention will be discussed. Among the items to be covered will be the use of loop seals, short-circuiting, application of suction tees and Y fittings, priming and foaming and the use of air and vacuum chambers on pumps.

FORMS FOR ENGINEERING WORK

A FORM for the calculation of heat losses is an important item in an office where considerable heating work is to be done. The calculations are more readily made, nothing is forgotten, since all is apparent at a glance to anyone at any time. The figures may be checked or frequently consulted, and for this purpose the several sheets relating to one building, should be bound together under a white print-cloth cover upon which the name of the building is neatly lettered. The folder is then filed with those of other installations, and when desired may be compared with the constants and figures as used in preceding cases.

In this way the coefficients of heat losses may be checked against practical experience acquired from actual installations, and in course of time may become the standards for the particular office using them. When these coefficients have been proven, their use should be established therein, rather than those advanced by any particular engineer who becomes a new employee of the office.

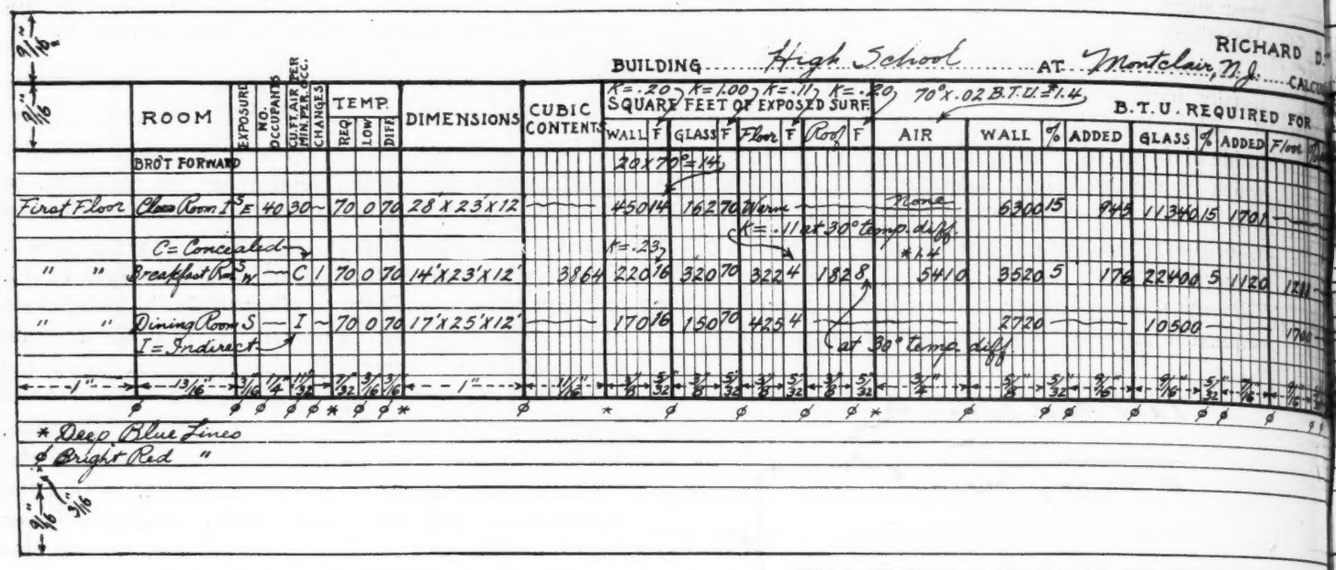


FIG. 1—TYPICAL FORM FOR CALCULATING HEAT

The use of these forms offers a compact presentation of the full data on one job while efficiency is furthered, since one kind of operation may be done at a time, both by the computer and checker, using a slide rule and working down the page rather than across. When the sheets are neatly bound, more pride is taken in their arrangement, while the work is apt to be more accurate than when scribbled in an unsystematic manner on whatever paper is at hand. Computations made on ordinary blank paper involve unnecessary work and the diverse workings of individual minds are followed rather than a set form.

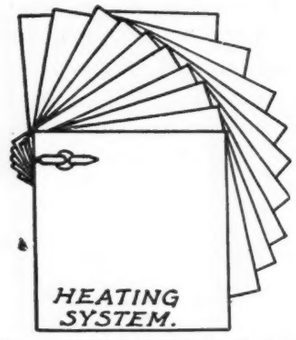


FIG. 2—METHOD OF BINDING DATA SHEETS FOR A GIVEN JOB.

Further, the requirements for ventilation as distinct from the heating are often made on separate papers at different times, and the paper so used may be of all sizes, and thus difficult to file.

DETAILS OF FORM.

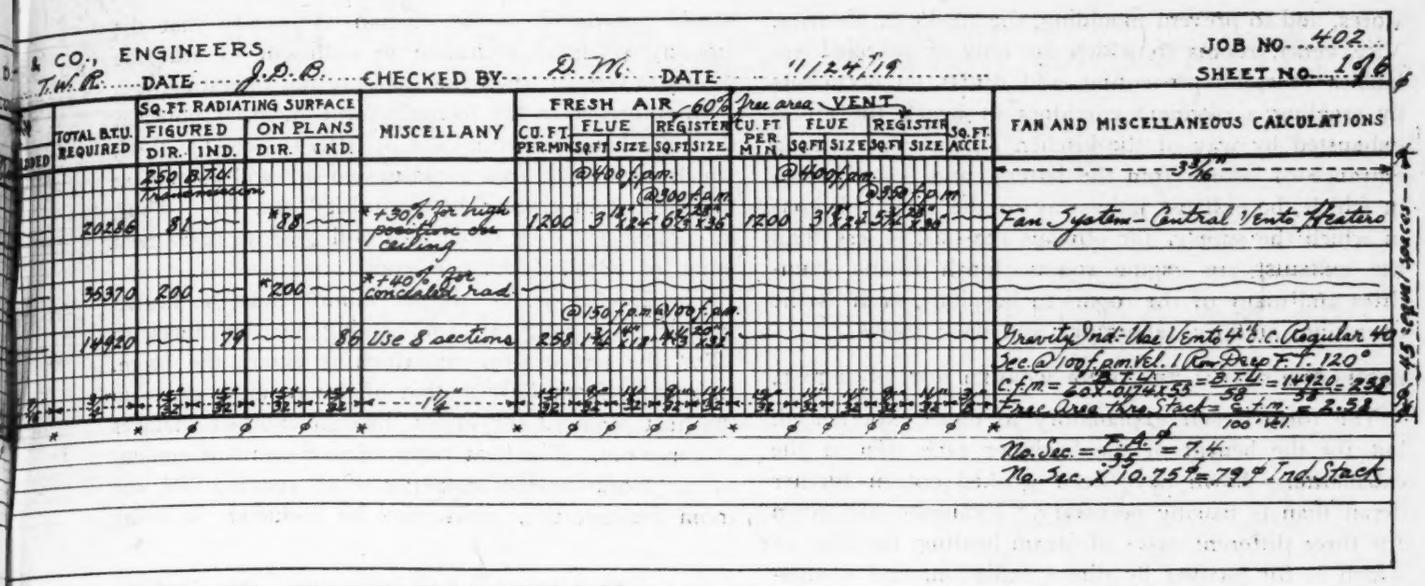
The size of the form is 11 in. by 24 in., with spacing of vertical and horizontal lines as dimensioned thereon. To save space, the form is not shown full width, there being forty-three horizontal lines, each for the heat calculations of one room. Heavy lines represent double lines while colored lines are noted by symbol. All other lines are a faint blue, except horizontal lines in the heading which are black.

At the top of the form, the name of the building is given, the date of calculation and check and by whom, the job or contract number and the sheet number. The total radiation and boiler, fan and motor loads are entered at the bottom of the sheet, and such totals are carried forward when there is more than one sheet. This form is adaptable to any kind of heating and ventilation work and various uses of the spare lines will readily occur to the computer as he becomes familiar with the method.

In figuring the heat losses for a building, it is a good plan to start with the basement and work up, recording each floor in the first column. It is also well to start each floor with the room on the same corner, working left to right until the circuit of the building is complete.

The name of the room is given in the second column, then follows the exposure, (whether north, south, etc.,) the number of occupants and the cubic feet of air per minute to be allowed per occupant for ventilation. When the problem is one of heating only, the last column is not filled out and instead the number of air changes of the room is decided upon and then entered in the next column.

After this is done, the required temperature to which the room is to be heated is noted, also the minimum temperature out-doors and the difference of the two. The last is known as the temperature difference and may also be any difference between the two sides of a surface through which a heat loss occurs, such as the heated side of a room and the opposite side in a unheated room or other space. The dimensions of the room are next recorded and from this the cubic contents are figured. The last dimension of the room is always reserved for the height; in fact, the method throughout should be consistent in detail not alone upon one particular installation but upon all others, also to eliminate errors of omission and make the process clear, a line should be


& CO., ENGINEERS
T.W.R. DATE J.D.B. CHECKED BY D.M. DATE 1/24/19
JOB NO. 402
SHEET NO. 196
SQ. FT. RADIATING SURFACE
FIGURED DIR. IND.
ON PLANS DIR. IND.
MISCELLANY
FRESH AIR 60% free area VENT
CU. FT PER MIN.
FLUE SQ. FT SIZE
REGISTER SQ. FT SIZE
SQ. FT. ACCEL.
FAN AND MISCELLANEOUS CALCULATIONS
TOTAL B.T.U. REQUIRED
250 B.T.U. Miscellaneous
20286 81 *88 +30% for high pour fore ceiling
1200 @400 fpm @300 fpm
Fan System - Central Vento Heaters
35370 200 *200 +40% for concealed rad.
14920 79 86 Use 8 sections
@150 fpm @100 fpm
258
Gravity Ind. Use Vento 4 S.C. Regular 40
Sec. @ 100 f.p.m. Vel. 1 Row Prep F.T. 120°
C.f.m. = 60 × .0174 × 53 = B.T.U. / 59 = 14920 / 59 = 258
Free Area thro Stack = c.f.m. / 100' Vel. = 2.58
No. Sec. = F.A. # / 35 = 7.4
No. Sec. × 10.75 # = 79 # Ind. Stack

LOSSES, ETC., WITH DATA FOR A GIVEN CASE.

drawn through such columns as are purposely excluded from the calculations.

Under the heading "Square Feet of Exposed Surface," the area of wall, glass and floor are noted, and opposite under "F," the factor by which each is to be multiplied. This factor is the product of the temperature difference times "K." The latter is noted at the top of each column and is the coefficient of heat loss or transmission per degree of temperature difference per square foot per hour of exposed surface.

The product of each area times its factor is entered in the approximate column under the heading "B. T. U. Required For" and when shown to be necessary in accordance with the notation under column "Exposure," a corresponding percentage is entered opposite each, and under column "Added," the addition is made. The columns which are without individual headings are reserved for such other exposed areas and their B. T. U. losses which may occur, such as floor or ceiling surfaces exposed to unheated spaces.

The summation of losses for all exposures and air changes is made under "Total B. T. U. Required," and this divided by the transmission per square foot of radiation per hour gives the total square feet of radiation to be installed, which is entered under "Direct" or "Indirect," as the case may be. Radiation may not always be obtained exactly as figured, so that the amount actually installed should be noted under the heading "On Plans." This is important, since at the bottom of this column on the final sheet of the series, the total load is shown. In the case of the column "Miscellany," it is apparent that this is required for imperative figures and remarks; for instance, in the first example given at the top of the form, all radiation is to be located on the ceiling and has been increased 30% to allow for its efficiency due to this position.

The number of occupants multiplied by the cubic feet of air per occupant is entered in the first column under the headings "Fresh Air" and "Vent" and these divided by the allowable flue velocities give the square feet of flue area and likewise the area of the register, with the exception that the latter may be determined at a different velocity. Further, the size of the register must be increased since the gross register area is not the net or free area. The nominal or catalogue register size is usually the two dimensions of the opening into which the register fits and the free area is usually 60% of the gross area. However, it is safer to use the exact value known for the particular make of register in mind, dividing the square feet as first determined for the register opening by the allowable percentage, the quotient being the gross area of required register opening. One well-known manufacturer of register faces in his standard design uses 7/8-in. square mesh with bars approximately 1/4-in.

Accelerating surfaces are sometimes installed in exhaust flues, the amount in square feet being entered where noted under "Vent." Finally, the use of the last column on the form is apparent, samples being given in two cases.

Referring back to air changes, the amount of exhaust may be greater or less than the supply. In such cases this should be shown as a fraction under "Changes," the numerator denoting the number of air changes supplied by fresh air and the denominator the number of air changes effected by exhaust. If the number is a whole number, it denotes fresh air only but if it appears, as for instance, 0/7, this denotes that no fresh air is to be supplied to the room direct and that seven air changes are to be exhausted, the air being drawn from other rooms through the one in mind.

Rooms in which air is exhausted only and not supplied are shower baths, swimming pools, chemical cabinets, coat, locker, and toilet rooms, slop sink closets, drying rooms of laundries, serving pantries, bakeries,

stores, and to prevent moulding, the stacks in libraries. Vice versa, rooms to which air only is supplied are lobbies (thereby preventing cold drafts on occupants by creating a plenum) corridors in which the air is exhausted by way of the kitchen (thereby preventing entrance of odors from the latter), and boiler rooms in which the exhaust is by way of the stack. Rooms in which the supply, for obvious reasons, is less than the exhaust, are engine rooms, lunch rooms, laundries and many of the rooms in hospitals, such as the operating, autopsy, laboratory and dark rooms.

EACH STEP OF CALCULATIONS WORKED OUT IN DETAIL.

The form is self explanatory to those experienced, but for the benefit of the beginner each step of the calculations shown have been worked out in further detail than is usually necessary. Examples are given for three different cases of steam heating, the first of which is for heating by direct radiation, and ventilation by fresh air and exhaust fans, the fresh air fans being set with central "Vento" heaters. For this condition, it is not correct to figure the cubic contents of the room, and B. T. U. for heating this air are not required under column headed "Air." In the second case, ventilation is not included, while the radiation, though direct, is concealed with consequent lessened efficiency. Therefore, for most conditions of this kind, the amount of radiating surfaces must be increased 40%. The third case is for gravity indirect heating, using "Vento" stacks, the method of figuring being shown under "Fan and Miscellaneous calculations."

The reason for allowing an increased exposure factor of 10% in the ventilated rooms (15% and 10%, Cases 1 and 3) is that such rooms have no leakage figured, and, on windy days when the room is on the windward side, the cold air may rush in around the windows to a discomforting degree unless some little additional surface is provided. On the other hand, in an unventilated room (5% for southwest exposure in Case 2), leakage for a complete change of air per hour is figured, and this is sufficient to care for all ordinary contingents. Owing to the leakage varying from between one-half to two air changes per hour (usually approximately one air change), and the ventilation running from four to twenty air changes per hour (usually approximately six to eight air changes), the leakage in ventilated rooms become relatively of minor importance.

In the case of schoolrooms, there is a further reason for increasing the exposure factor since with some school boards, it is the custom to specify that the amount of direct radiation be sufficient to heat the rooms to 60° F. when the fans are not operating.

In reference to the formula for c. f. m. as noted at the right-hand side for Case 3; 0.0174 is the B. T. U. which each cubic foot of saturated air will contain at the mean temperature between 125° and 70°. Thus, in cooling 55° each cubic foot will give up 0.957 heat units, or 58 B. T. U. per hour.

The 258 cu. ft. of air per minute must be heated to 125°, allowing 5° for cooling in the ducts to 120,° the temperature at which it enters the room. In cooling from 120° to that of the room, it gives up the heat required for losses through exposed surfaces of the room. The heat required to warm this amount of air from outside temperature of zero to 70°, the room temperature, must also be included; it being

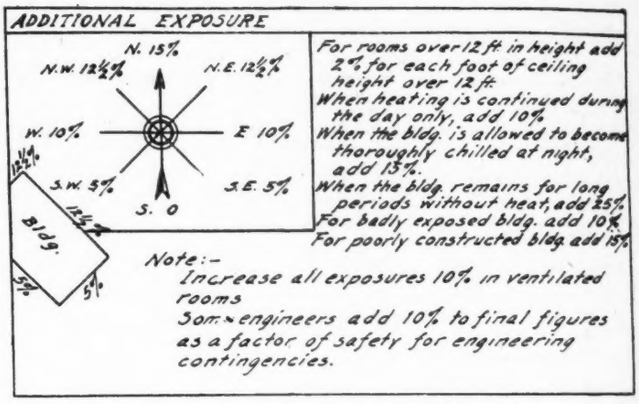

ADDITIONAL EXPOSURE
N. 15%
N.W. 12½%
N.E. 12½%
W. 10%
E 10%
S.W. 5%
S.E. 5%
S. 0
Bldg.
For rooms over 12 ft. in height add 2% for each foot of ceiling height over 12 ft.
When heating is continued during the day only, add 10%
When the bldg. is allowed to become thoroughly chilled at night, add 15%.
When the bldg. remains for long periods without heat, add 25%.
For badly exposed bldg. add 10%
For poorly constructed bldg. add 15%
Note:-
Increase all exposures 10% in ventilated rooms
Some engineers add 10% to final figures as a factor of safety for engineering contingencies.

FIG. 3—EXPOSURE CHART.

obvious that this air at 70°, together with its heat is lost from the room.

Referring then to the "Condensation Chart" in the "Vento" catalogue, note that at 100 f. p. m. through one stack deep, the B. T. U. transmitted per square foot per hour are approximately 400. Therefore, 400 × the 86 sq. ft. of heating surface selected = 34,400 total B. T. U. transmitted.

258 c. f. m. × 60 = 15,480 c. f. per hour.

$$\frac{15{,}480 \times 70 \text{ deg.}}{55 \text{ cu. ft.}} = 19{,}700 \text{ B. T. U. required.}$$

19,700 B. T. U. required to heat air from 0° to 70° plus 14,920 B. T. U. required to offset heat losses or to heat air from 70° to 120° = 34,620, total B. T. U. required. This checks closely with 34,400, the total B. T. U. transmitted.

HEATING SYSTEM FOR A MODERN CATHEDRAL

Scheme Adopted for Counteracting Cold Drafts in Lofty Interior, Together with Unique Method of Heat Control.

II

By CHARLES L. HUBBARD.

(Concluded from April issue.)

SUPPLY AND RETURN PIPING.

The system of piping for the return of distribution of steam to the heaters and for the return of condensation is one of extreme simplicity for its size, and is designed to reduce to a minimum the amount of valve manipulation in regulating the flow of steam. In planning this work it was taken into consideration that the greater the number and the more scattered the controlling valves, the greater the liability of their neglect or disuse. Hence a simple scheme was designed for reducing the regulation for the entire building to the manipulation of a single valve.

While each section of the building and each heater in these different sections are provided with valves in supply and return, these are for use only for cutting out the heaters in case of repairs or for other reasons, and are not to be used for regulating purposes.

The principle of the system is illustrated diagrammatically in Fig. 8. The mains are divided into four principal sections, each one of which supplies a portion of the heaters, some 66 in all. In the actual layout, two of these sections supply the nave, a third the apse, choir, chancel and north transept; and the fourth, that portion of the building including the south transept.

Pipe sizes have been proportioned on a basis of 1/8-lb. drop in pressure per 100 ft. of run, when supplying the maximum quantity of steam required. This has been done in order to insure as uniform a pressure as possible throughout the system of piping, regardless of the distance from the central source of supply, a

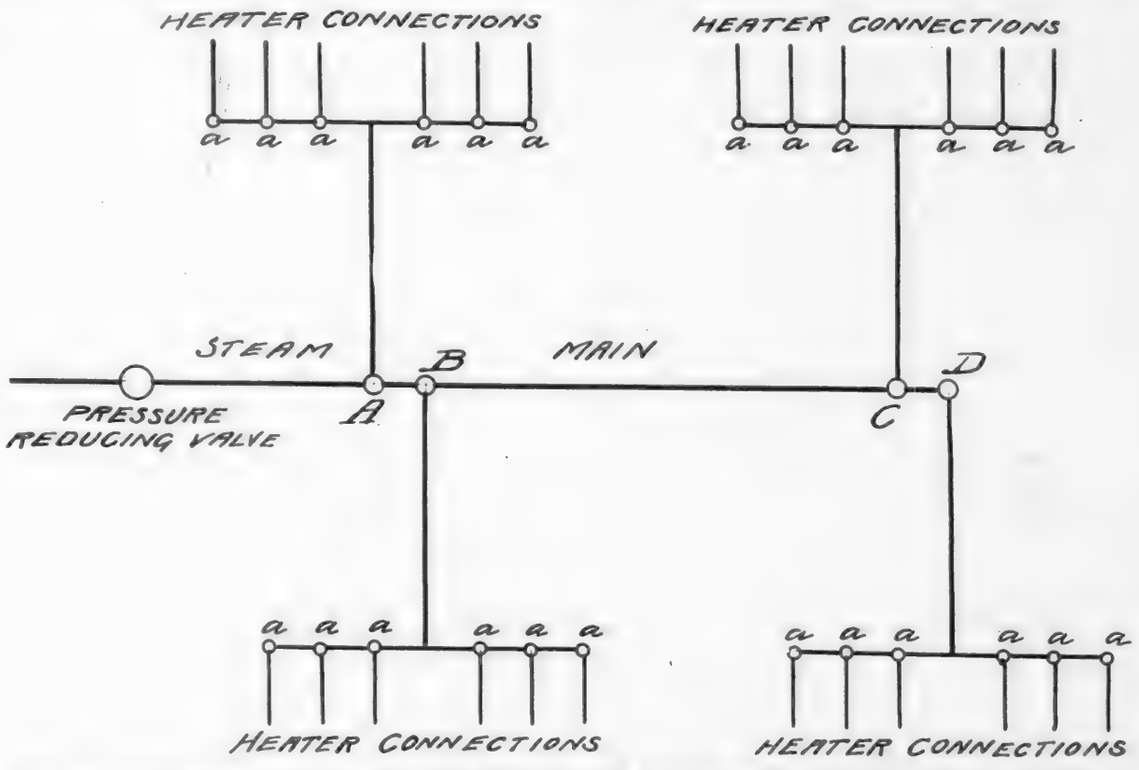


FIG. 8—PRINCIPLE OF ARRANGEMENT OF SUPPLY AND RETURN PIPING, WASHINGTON CATHEDRAL.

condition essential to the proper working of the particular scheme employed.

Steam is passed from the main into each of the four principal sections (see A, B, C, and D, Fig. 8) through a bored flange plate of the general form shown in Fig. 9. The size of the orifice in each case is such that under 10 lbs. difference in pressure on the two sides of the plate, just enough steam will flow through to supply the maximum quantity which will be condensed by the heaters on that line under the assumed working conditions. When the pressure difference falls below 10 lbs., the quantity of steam passing through the ori-

fice will vary nearly as the square root of the difference.

For example, if the pressure difference falls to 1 lb., the flow of steam will be slightly less than one-third of what it is at 10 lbs., and the heat given off by the group of radiators on that line will be reduced in the same proportion.

With this arrangement it is evident that the quantity of steam fed into each of the four branch lines, through A, B, C and D, may be varied at will by simply changing the pressure in the steam main, which in turn receives its supply through an automatic regulating valve. This valve may be set to deliver steam at any pressure from 1 oz. to 30 lbs. per square inch. Therefore, the steam supply to the principal main controls the supplies to the four branch lines through manipulation of a single valve which is automatic in its action when once set for any given pressure.

The steam quantity to each individual heater is also controlled by a similar bored bushing in the supply pipe (a, a, a, a, Fig. 8,) the opening being of such size that with a pressure difference of 10 lbs. between the supply pipe and the heater, the quantity of steam passing through will just equal that condensed by the heater under maximum working conditions.

From this description it is evident that to maintain a heater constantly filled with steam at atmospheric pressure, there must be a uniform pressure of 10 lbs. per square inch in the branch lines and 20 lbs. in the main. Under this condition the heater will remain steam-filled, but there will be no tendency for it to flow out through the return pipe, even though the lat-

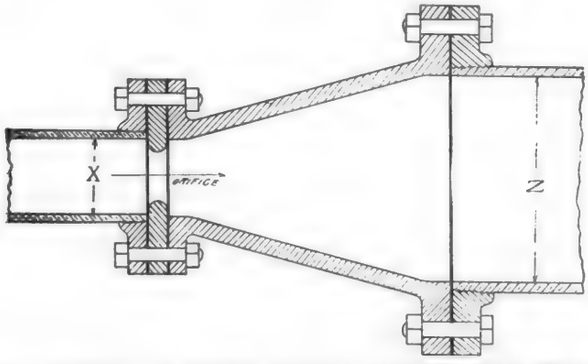


FIG. 9—DETAIL OF BORED FLANGE LEADING FROM STEAM MAIN TO THE FOUR DISTRIBUTING LINES.

ter is directly open to the atmosphere, because the pressure is the same within the heater as it is outside, and the steam supplied in a unit of time is just equal to that condensed in the same period. This is the condition for maximum capacity under normal working conditions, and what has been said regarding a single heater applies to each unit in the entire system. If less heat is required to maintain the normal temperature of the building, the pressure in the main is reduced by readjustment of the regulating valve which in turn reduces the quantity of steam passed into the four branch lines through the openings at A, B, C and D, and likewise that delivered to the heaters. The proportion of reduction will be the same in each heater, owing to the method of distribution through bored bushings, and no manipulation of valves will be required except the single adjustment of the pressure-regulating valve in the supply main.

By careful observation it should be a simple matter to make out a schedule of pressures to be carried in the main to admit the required amount of steam to the heaters to maintain a uniform inside temperature for

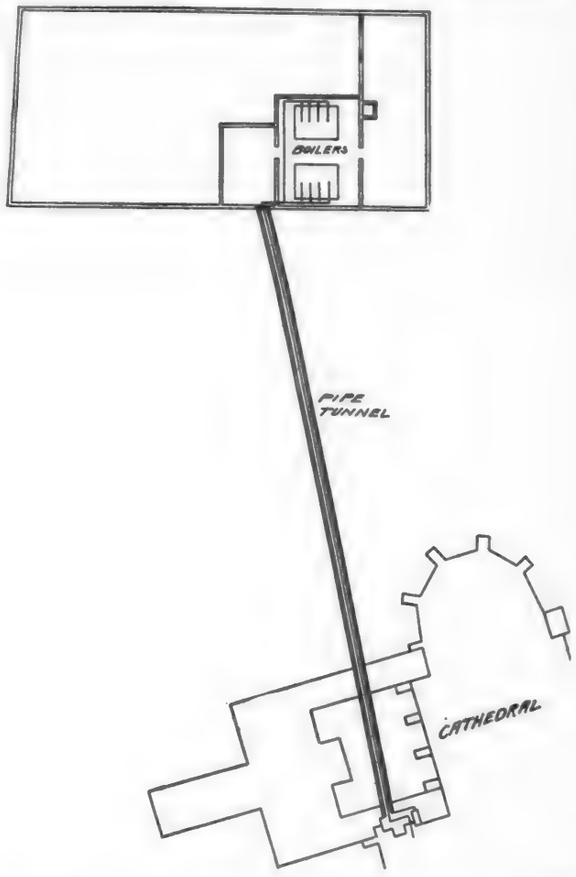


FIG. 10—LOCATION OF BOILER PLANT AND PIPE TUNNEL.

varying outside weather conditions, both as to temperature, cloudiness and wind pressure, or any combination of these.

AIR VENTING AND RETURN OF CONDENSATION.

Starting with a cold system, filled with air, the first action of the passing of steam into the heaters is the displacement of the air which, owing to the continuous interior passage (see Fig. 5), is gradually forced out without mixing with the steam. If, when the heater is partially steam-filled, the supply is gauged to just equal the condensation which takes place under this condition, part of the heater will remain filled with steam while the remainder will contain air under the same pressure. Varying the steam supply up to the full condensing capacity of the heater will simply vary the proportions which are steam-filled and air-filled, without changing the pressure. If the steam supply is gauged to that which will be condensed by

one-half the radiating surface of the heater, then the latter will stand half full of steam and half full of air. If more heat is required, say an amount equal to three-fourths the capacity of the heater, the pressure should be raised so that the inflow will be just three-fourths the total condensing capacity of the heater,

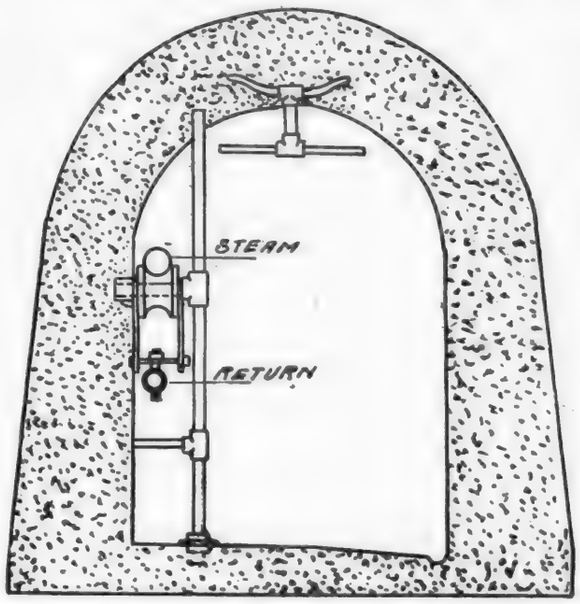


FIG. 11—SECTION OF PIPE TUNNEL, WASHINGTON CATHEDRAL.

the result being that more air is forced out until the heater stands three-fourths full of steam and one-fourth full of air.

During all this time there will be no change in pressure in the heater and the condensatinon may flow out though a return connection open to the atmosphere. Unless the heat losses from the building prove much greater than expected, it will never be necessary to carry steam in the heaters above atmospheric pressure, in which case no valve of any kind will be needed at the return outlet, the condensation simply draining into a return pipe vented to the atmosphere, and flowing back by gravity to an open tank in the boiler room. While the system is supposed to operate under these conditions normally, provision has been made, as previously stated, for carrying higher steam pressures in case of emergency.

To cover this possible condition a thermostatic trap valve has been provided for the return outlet of each heater. This trap ordinarily stands open for the free passage of air and water, but should the steam pressure rise above that of the atmosphere, so as to raise the temperature above 212°, the trap will close and only admit the passage of water which has cooled to a point below 212°.

In order to dispose of the air as soon as possible after it leaves the heater, a vent is connected with the return pipe, just below the trap, and carried to the nearest roof conductor pipe. Water is prevented from entering these vents from the conductors by the use of an inverted siphon or "goose neck."

The condensation mains leading back to the boiler room are given a slight downward pitch so that the water flows back by gravity. Pipes are so proportioned that they will be only half-filled with water under maximum working conditions.

PREVENTION OF REVERSE CURRENTS IN AIR FLUES.

As will be noticed in Fig. 3, the height of the uptake flues leading to the triforium level are considerably higher than the corresponding downtakes, and, furthermore, are located within the cold outer walls. For this reason, in the early Fall, before steam is turned into the system, there will be naturally a reversal of current through these heating circuits, due to the greater height and lower air temperature of the uptakes. To overcome this condition and start the air current in the right direction, at such times, each of the uptakes to the higher level, with two or three exceptions provided for in another manner, are furnished with a loop of heavy brass pipe extending for practically the full height and containing about 60 sq. ft. of heating surface. With this arrangement, the air of the flue is warmed and started in an upward direction.

In the case of the heating circuits shown in Fig. 4, the uptakes and downtakes are of the same height and are exposed to practically the same temperature, so that there is no danger of reversal, and steam loops are not needed.

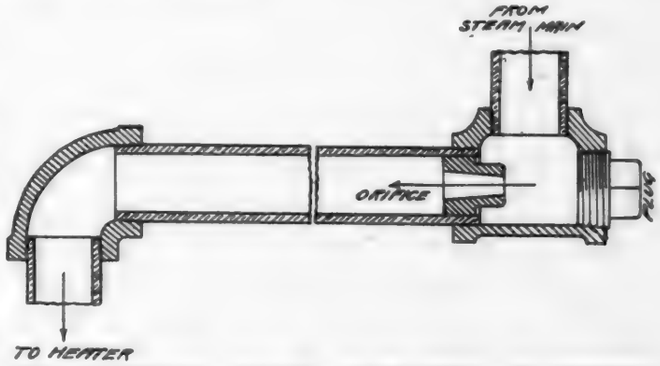


FIG. 12—TYPICAL HEATER CONNECTION, WASHINGTON CATHEDRAL, SHOWING BUSHING.

STEAM SUPPLY.

The steam supply for the Cathedral is brought from a boiler plant through an underground tunnel 400 ft. in length, as shown in Fig. 10. A section of the tunnel, showing the general form and method of supporting the heating mains, is illustrated in Fig. 11.

CONSTRUCTION DETAILS.

The object of the present article has been a discussion of general methods and the novel features employed, rather than a description of details of construction, which do not differ essentially from those of the ordinary plant. However, in closing, it may be interesting to note briefly certain matters relating to some of the equipment previously mentioned.

A detail of one of the bored flanges leading from the

steam main to the four distributing lines has been shown in Fig. 9. The openings are accurately finished to the required size, the diameters varying from 1.82 in. to 2.2 in. for the different branches. The high-pressure connections, X, leading from main, vary from 3-in. to 3½-in., while the low-pressure distributing branches, Z, start with a uniform size of 8 in.

A detail of a typical heater connection, including the bushing, is shown in Fig. 12. The latter consists of a cast-iron plug, bored on a taper to the proper size, and screwed into the end of the pipe with a wrench, no threads being cut except by the action of the bushing in the process of insertion. A removable plug is provided opposite the bushing for cleaning or removing, as may be necessary. The diameter of the orifice varies with the size of the heater supplied and runs from 19/64-in. to 36/64-in.

Typical heater connections, illustrating the returns as well as the supplies, are shown in Figs. 6 and 7. Referring to the former, the steam supply is taken from the bottom of the main to facilitate drainage, and a dirt pocket provided directly under the vertical drop, the supply connection being taken from the side. A similar pocket is furnished in the return, with the thermostatic trap connected into the side. Branches leading to the air vent and condensation return are clearly indicated in the drawing.

Genuine soft wrought-iron pipe, lap-welded above 1½-in., and of standard weight, was called for throughout the work, with the exceptions previously noted. Fittings in general are standard weight, cast-iron and heavily beaded. Valves are of wedge-gate pattern, with removable discs and seats, designed for 125 lbs. steam pressure. Sizes 2-in. and below are of brass; above this size, iron bodies, with brass finish. Valves 4-in. and above have rising spindles. The pressure-reducing mechanism for supplying steam to the main consists of an 8-in. balanced valve, operated by a Locke damper regulator, the former being provided with cut-out valves and bypass.

POINTS ON MAINTAINING UP-TO-DATE CENTRAL HEATING SERVICE

With Special Attention Directed to Such Matters as Customer's Idea of Service, the Factor of the Size of Building and Common Heating Defects

By F. A. Tucker.

Heating Engineer, Danville (Ill.) Street Railway and Light Company.

PUBLIC utilities are generally monopolies, from the nature of their business. Most States have recognized this fact and have undertaken to define the rates at which public utility commodities shall be sold and to prescribe certain standards intended to insure to the consumer a definite quality of service from these commodities. The problems of fixing a just and reasonable rate for central heating service, and of prescribing standards for that service are usually more complicated than the corresponding problems in gas; water and electric service, because of the fact that so many of the variables affecting the service are out of control of the heating company.

TWO INTERPRETATIONS OF SERVICE.

A consideration of the meaning of service in the central heating business will show that it can have at least two interpretations. From the standpoint of the company, it might be considered that everything necessary for good service had been done when a certain reasonable steam pressure or, in the case of a water heating system, a certain reasonable differential pressure together with a certain reasonable water temperature, is maintained. These things are, it is true, absolutely necessary to good service. Yet, from the consumer's standpoint, it is cold comfort to be asked to look at the nice even line on a pressure or temperature chart. What the consumer regards as one of the principal elements of heating service is being kept warm. Likewise, the company may have secured from its regulatory body a rate regarded by all who know as eminently fair and reasonable. Yet this fact may not make his January bill look reasonable to the consumer. In short, regardless of the company's position, the consumer will demand that his premises be kept at a suitable temperature the year around for what he thinks is a reasonable sum of money.

WHY THE CONSUMER'S IDEA OF SERVICE MUST RULE

In the long run the consumer's idea of service must rule if the company is to continue in business. For although the company may have a monopoly of the district heating business in its community, it is usually far from enjoying a monopoly of the heating business. Except in the case of large consumers, the bills for gas, electric and water service are not usually such a large percentage of total expense as are the heat bills, and may not be subject to as close scrutiny. For this reason also the consumer of the three utilities mentioned is rarely willing to go to the trouble and expense of installing and operating a private plant capable of giving service equal in quality

to that of the central station. Again, the large consumer, particularly in the large cities, is the exception to this rule. In smaller cities where the central heating plants have flourished, it will be found to hold good as a general thing.

On the other hand, the consumer in these smaller cities can install, operate and get a reasonable quality of service from his private heating plant at a cost comparing very favorably with that of the central station service, and, many times, at less cost. Such a consumer is often willing to discount the trouble of firing his own boiler and handling his ashes. Competition in the central heating business is not removed by the possession of a franchise to operate a distribution system in the city streets.

THREE SIDES TO THE PROBLEM OF HEATING SERVICE.

The problem of heating service is a three-sided one. First, we have the side of the company—the adequacy of its plant and distribution system and the adequacy of its rates. Second, we have the side of the consumers' equipment, which must consider the condition of the building to be heated and of its heating system, both with reference to quality of service and cost. Third, we have the side of the consumer himself—the problem of bringing him to appreciate the value of the service and to see that maximum service can only be rendered with his co-operation, no matter how carefully all rules and regulations are carried out.

IMPORTANCE OF MAINTAINING SUITABLE SUPPLY OF HEATING MEDIUM.

It is a fundamental duty of the heating company in maintaining service to see that a suitable supply of the heating medium is at all times available. In a steam system this is accomplished by the installation of a pressure-recording gauge at the weakest point in its distribution system, and the maintenance of a certain minimum pressure, (usually 1 lb.) at this point at all times. The gauge in question should be of the long-distance type, registering the minimum pressure electrically at the plant. The plant pressure is adjusted in accordance therewith. In a water heating system the temperature of the water leaving the plant should be varied according to a predetermined schedule properly in synchronism with the outdoor temperature. Of course, the temperature of both the flow and return should be recorded by a recording gauge.

The quantity of heat received in a water heating system is further affected by the size of the choke disc placed in the consumer's service, and a judicious distribution of these discs is essential to good service. The foregoing precautions will be of small avail, of course, if either the plant or distribution system is not big enough to furnish the proper quantity of heat. If this condition exists, it is the duty of the company to enlarge its plant or distribution system or persuade enough consumers to discontinue service until the heat supply equals the demand.

ADEQUATE RATES, CONSIDERED FROM STANDPOINTS OF BOTH COMPANY AND CONSUMER.

If a heating company is to render service at a reasonable cost to the consumer it must have adequate rates. Rates are commonly accepted as adequate when they pay the company a reasonable return on the fair value of the property used in rendering the service. This is not enough, however, as the rates must also be within the value of the service to the consumer. In this connection it is of interest to note that the problem of the heating company is not essentially different from that of an industrial concern. There will be, in any particular case, a certain number of square feet of radiation which can be served at maximum profit; or, since the profit of a public utility company is supposed to be limited, at minimum cost per square foot of radiation.

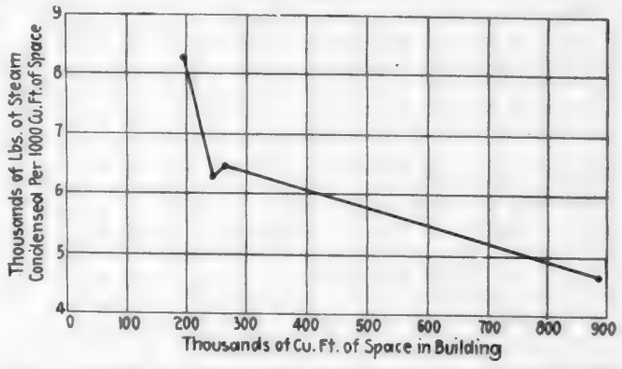


FIG. 1—GRAPH ILLUSTRATING TENDENCY OF CONDENSATION RATE TO VARY WITH SIZE OF BUILDING—INDIVIDUAL OFFICE BUILDINGS.

In some cases the amount of this connected load may be controlled by the amount of exhaust steam available, or it may be controlled by the investment in mains made (perhaps injudiciously) at some prior time. A decrease in the connected load below this critical point would result in an increase in the charge per square foot of radiation.

Insofar, then, as the question of service is an economic one, it is to the interest of both company and consumer to have the proper load, as nearly as may be. Such being the case, it follows that the heating rate must not only consider the value of service to the average consumer, but also the value of service to the consumer who values it the least and who consequently is the hardest to secure and the easiest to lose.

THE SIZE OF BUILDING AS A FACTOR IN DETERMINING VALUE OF SERVICE.

The value of heating service will be found to depend, in general, and without considering special advantages, on the size of the building and the financial prosperity of the consumer. With reference to the size of the building we may have two cases. One is the very small building where the condensation rate (in a steam heating system), is relatively high per unit of space or radiation heated. It is a comparatively easy matter for such a consumer to provide his own heat. It is possibly true that this type of building would not

be considered especially desirable from the standpoint of central heating business, yet every heating system in cities of the smaller size has connected such buildings in the past, and it is not difficult to find cases where the loss of the smaller buildings as heat consumers would prove an economic loss to the company and hence to the consumers.

LARGE BUILDINGS POSSIBLE COMPETITORS.

The case of the large building or large heat consumer is more serious than that of the small one. The facts that this consumer generates his heat more economically than a smaller one, is usually a considerable employer of labor under any conditions, and has the ready command of capital render him a real competitor, not only for his own business, but possibly for that of one or two neighbors or an entire block.

One instance will illustrate the influence of the financial prosperity of the consumer on the value of heating service. In a certain section of a city changing business conditions caused the efflux of a large number of prosperous, high-rent-paying consumers. They were replaced, in the course of time, by a poorer class of tenants, financially of the type of

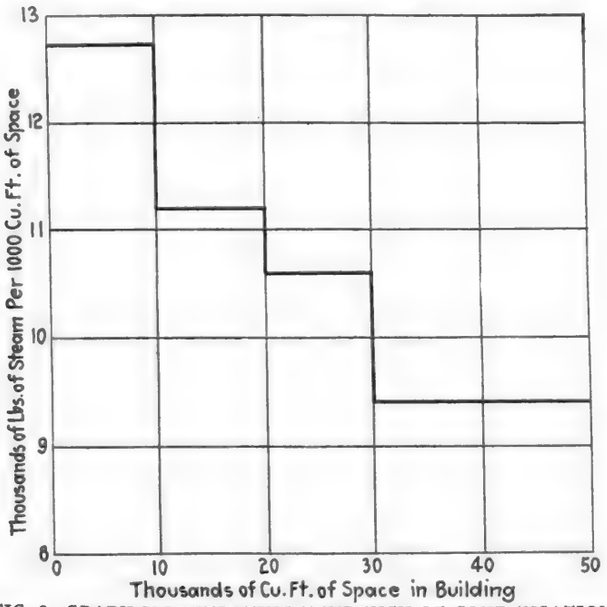


FIG. 2—GRAPH ILLUSTRATING TENDENCY OF CONDENSATION RATE TO VARY WITH SIZE OF BUILDING—AVERAGE RESIDENCES.

small merchants. These tenants each did a relatively small amount of business on a small amount of capital and the heat bill became a large per cent of total expense. Central heating service became to them a luxury and was valued as such. Such a condition could hardly be foreseen or dealt with by any reasonable adjustment of rates yet it is one of the problems confronting the heating manager.

To summarize the foregoing considerations on rates as affecting the value of service, it may be said that as far as possible, the heating rates should not only be correct as to total revenue derived, but should also be of a form to make it possible to secure and retain the proper amount of heating business.

LACK OF SUFFICIENT RADIATION OFTEN FOUND IN CONSUMERS' BUILDINGS.

The condition of the consumer's building and heating system is one of the most important factors affecting heating service, both as to quality and price. The condition of the building itself is the first consideration. If the building has very loose doors and windows, or the basement windows have a few panes of glass broken out, or the attic is very open, it is, of course, impossible to keep the building warm and the amount of heat consumed in the attempt is excessive. It should be remembered, too, that building repairs require constant attention for best results. A building satisfactory one year may be far from being so the next.

CENTRAL STEAM HEATING SYSTEMS CANNOT BE FORCED.

A common fault in older buildings especially is lack of sufficient radiation, with the result that on cold

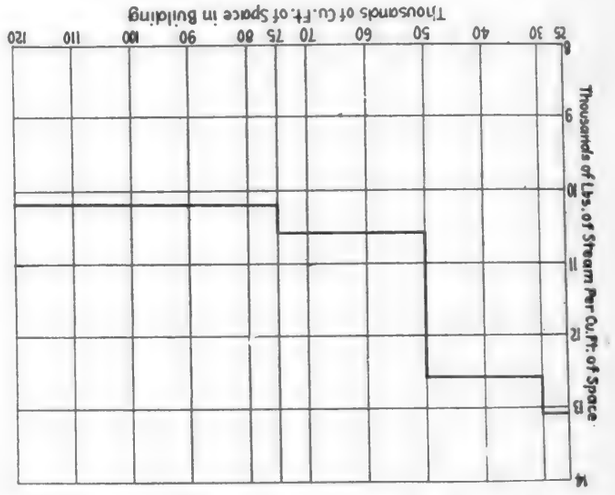


FIG. 3—TENDENCY OF CONDENSATION TO VARY WITH SIZE OF BUILDING—AVERAGE APARTMENT BUILDINGS.

days the consumer complains. This fault may be due to lack of care or knowledge on the part of the original heating contractor, or to a desire on the consumer's part, to cut down on expenses by skimping on radiation. It is well to remember that a heating system supplied with steam from a central plant cannot be forced, as can an individual boiler plant. That is, in an individual plant the radiators can be increased in temperature, within limits, by increasing the boiler pressure, whereas steam from a central plant is supplied at a temperature varying within much narrower limits.

COMMON HEATING DEFECTS.

Another common fault in customer's heating systems is failure to utilize the heat in the condensate. While this might not at first glance appear important in improving quality of service, yet it enables the consumer to get the benefit of the maximum heating

power of his heating system and is, of course, a direct saving.

A fault becoming less common since the introduction of steam meter rates is that of exposed piping in places where no heat is needed. There is no necessity for emphasizing this point other than to say that unless prevented, most people will cover their pipes with the cheapest covering possible, having usually the lowest insulating value, and hence fail to realize the saving expected. It is advisable for the company to insist on high-grade covering.

There are a number of other heating system defects not as common as the ones just mentioned, but which will just as surely cause trouble. Radiators may be found so badly connected that they will not drain properly. Pipe lines may be too small, especially in the case of long horizontal branches or run-outs. Radiator air-vents may become plugged up.

In some cases all the air-vents in a building may be connected to a piping system to prevent air being discharged to the rooms. These piping systems, unless made of at least ½-in. pipe, are particularly troublesome and aggravating. In atmospheric or vapor systems it is not uncommon to find the pressure-reducing valve sticking, due to an accumulation of grease and dirt on the valve seats. The list of these minor troubles could be increased almost indefinitely.

DUTY OF COMPANY TO POINT OUT DEFECTS.

Inasmuch as the condition of the consumer's building and heating system play such an important part in service, it becomes the duty of the company in rendering good service to point out to the consumer the defects and their remedies. Indeed, it may be considered the duty of the company, in the broadest sense of service, not only to point them out, but to stay with the job until the defects are remedied. It is a peculiar fact that many times the source of trouble in his building can be made perfectly clear to a consumer, and yet if he is left alone without having corrected it, he will somehow retain an impression that the company's service is poor or his bill is exorbitant. Whenever a discussion of "city heat" service comes up, such a consumer can be depended upon to contribute his little "knock."

GETTING A CONSUMER TO PUT HIS HEATING SYSTEM IN PROPER CONDITION.

The process of getting a consumer to the point of actually putting his building in good condition involves at least two factors. The first includes all such contributing factors as tact, personality, force, etc.; in short, the ability to deal with human nature. The second factor requires that the company's department for handling such matters be competent. It must be remembered that in making recommendations for improvement, this department will come in contact, and often into argument, with the heating contractors whom the consumer has come to rely on. It would seem that in order for the recommendations of the heating company to have the necessary authority and command the proper respect, the department in question should be at least as competent as the best heating contractor in town. Moreover, it is a disastrous thing to have a consumer spend possibly a goodly sum of money on the advice of the heating company, and then to have the expected results fall short of accomplishment.

CONSUMER SHOULD BE PERSUADED TO REGULATE HIS HEAT.

The economy of service depends to a large extent on the care with which the consumer regulates his heat. It is here the company has the greatest opportunity for the exercise of persistence, patience and tact in pointing out the proper methods of regulation and persuading the consumer to practice them.

IMPORTANCE AND DUTIES OF "TROUBLE SHOOTERS."

To render heating service as complete as possible it is usually necessary to employ one or more trouble

Form No. @ 8-17-17 2500

STEAM HEAT DEPARTMENT No. 699

Name .....

Address .....

Has reported to ..... @ ..... M. ..... 191..

That .....

Main Pressure .....

Valve .....

Piping .....

Radiators .....

Trap .....

Meter .....

Hot Water .....

Work Done .....

Trouble Remedied, Yes—No .....

By ..... @ ..... M. ..... 191..

FIG. 4—FORM FOR USE OF "TROUBLE SHOOTER."

shooters. The duties of these men are to answer calls from consumers, to find the cause of the trouble and if it is due to some fault of the company, to remedy it. If the trouble is due to the building or heating system of the consumer, the "trouble shooter" should usually report to the proper individual at the company's office, who will, in turn, go back to the consumer.

In a good central heating system, emergency trouble will nearly always lie with the consumer or his equipment. The question will arise as to how far the company should go in remedying trouble with consumer's equipment. A fairly satisfactory policy seems to be that the company's "trouble shooter" shall act in the nature of first aid, doing whatever is necessary to prevent the consumer suffering serious discomfort or damage until the heating contractor can be called and make permanent repairs. In this way the consumer realizes that he can secure prompt assistance when he is in trouble and yet cannot impose on the company for unreasonable repairs. Promptness is the essence of this service, but it must be entirely competent as well.

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THE TIME has come for the heating industry to take concerted action to see that the carefully-designed heating and ventilating systems installed in buildings, such as schools and similar structures, at least, shall be operated in the way they were intended to operate, and not be subject to the whims or the deliberate neglect of the operating engineer. There is no more serious matter confronting the industry at the present time and it will pay handsomely in dollars and cents, to say nothing of the effect it will have in securing a better respect for the work of the designer, to go to great lengths to change the present condition of affairs. It is not necessary to cite instances of the improper operation and non-operation of such systems. They are all too common and as long as sharp-witted janitors can control the by-pass in the fresh air supply and come through at the end of the month with an impressive saving in the fuel bill, so long will much of the good work of the engineer who laid out the system be brought to naught and the entire profession discredited.

There is, of course, nothing new in this situation. Various steps have been proposed from time to time, such as placing the operating conditions under the control of the designing engineer. What is needed is a continuous propaganda intelligently directed and maintained throughout the country, based upon arguments something like the following:

When there is divided authority in these matters, no one can be held strictly accountable for the resulting conditions, as each one can claim lack of complete jurisdiction. As a practical proposition, it is impossible to secure proper co-operation between the different officials having control in these matters.

It is obvious that the officer supplying fuel, oils, etc., to be used in the operation of the plant is personally more vitally interested in first costs of such supplies than he can be in their effect upon the cost of maintenance or the cost of labor involved.

Where control of operating conditions, selection of plant operatives, etc., are separate from control of design, there is no assurance that the plants will be operated as designed, and the design may be condemned when the real cause for complaint is improper operation.

With divided control of design, operation, supply, furnishing, etc., it is difficult to study operating conditions as should be done, with a view to improvement in design. This is true because there is usually a lack of co-operation between the several officials, for the reasons already stated.

With the selection and purchase of fuel, etc. and the appointment and control of operatives by persons independent of the designing engineer, it is almost impossible for such designing engineer to secure the data necessary for the best design.

With one person or department responsible for the design, installation, maintenance and operation, including the appointment of janitors, the supervision of janitors and engineers and the selection of fuels and supplies used in plant operation, he can select designs, supplies, etc., and select and train operatives, with a view to the best possible overall efficiency and the comfort of the occupants. He can effect economies in staff, since the one set of inspectors, clerks, etc., can handle all phases of the service without the duplication of work, and the inter-bureau correspondence involved in carrying on the several bureaus under divided control.

These, then, are the facts in the case. The difficulties in changing the system, no doubt, are great. That the system, however, is wrong in principle and unsatisfactory and wasteful in practice is the trump argument in starting a campaign for a change.

WITH co-operation as the watchword in American commercial life it is difficult to understand how it comes about that three of the big conventions in the heating trade should all be held on the same dates, and in different cities. There are, of course, many men accustomed to attend at least two of these conventions who will not only be deprived of the benefits that would ordinarily accrue to them, but, what is even more important, the organizations themselves will be distinct losers in being deprived of the benefit of the advice and counsel of some of their most valuable members. It is to be hoped that the associations themselves, if necessary, will take steps to coordinate their convention dates so that each convention may be of the greatest value to its own members, at least, as well as to the trade at large.

The programs for all three conventions indicate that much valuable matter in the way of papers and reports will be presented and in order to do them full justice the reports of the master steam fitters' and the heating engineers' conventions will be published in our June issue, and that of the National District Heating Engineers will appear in July.

WRINKLES

Miscellaneous Details of Fan Blast Heating.

Dampers in underground concrete ducts are not readily accessible and unless well designed and constructed they have no degree of permanency. The design shown in Figs. 1 and 2 has been successfully used for such conditions. The distribution of air to the various branch ducts is effected by means of these volume deflectors. The construction is of No. 12 gauge steel-plate, braced by angles and securely hinged to the duct, adjustments being made along a 3/8-in. by 1 1/4-in. iron strap punched on 1 1/2-in. centers for this purpose. When the pressure of air into each branch duct under normal working conditions is approximately the same the deflectors are permanently fastened into position.

When an underground concrete duct divides into two right-angled branches, a stationary deflector or divider is required to equalize the flow into each branch. Such a device is shown by Fig. 3. It is constructed of No. 12 steel, bent to an easy radius and braced.

A volume damper located in an overhead sheet-metal duct is shown in Figs. 4, 5 and 6. It is made adjustable as shown so as to deflect the proper quantity of air into the smaller and less favored of the two trunk ducts which divide at this point. A condition sometimes encountered is a building upright or other necessary interference passing through the duct. In Fig. 4, the upright is enclosed in sheet metal so arranged as to deflect the air currents and minimize the resistance to their passage.

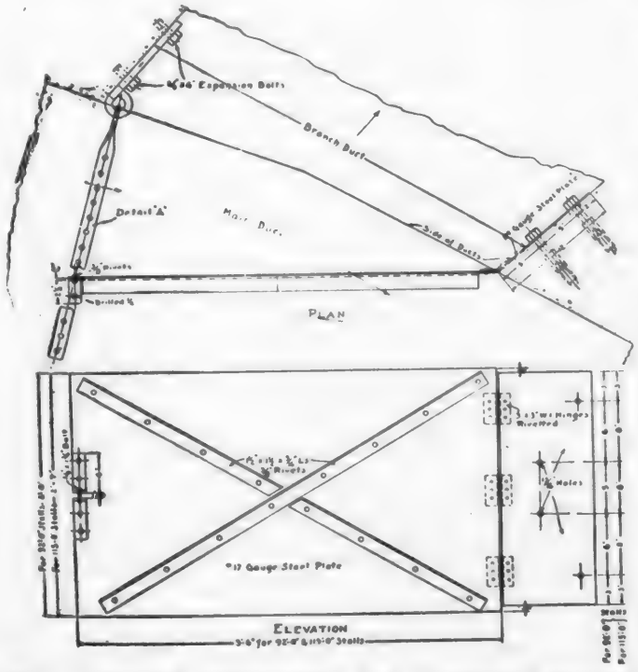


FIG. 1—VOLUME DEFLECTORS FOR CONCRETE BRANCH AIR DUCTS.

A Y-shaped junction or breeches joint is used when the main duct splits into two branches. As shown in Fig. 7, a deflector or switch valve is installed to divert the current wholly or partially from one branch to the other.

Slip joints on sheet-metal work are evidence of poor workmanship. However, when used (in particular with dust-collecting systems), the small end of one length of pipe should enter the socket end of the next length in the same direction as the air current. This is shown by the arrow in Fig. 8. Such a condition may be obviated by using the single-lock standing seam, also shown in the sketch. This is a good method for securely joining duct work. It does away with air leakage and offers a clean butt joint, so that the resistance to air flow is minimized and the collection of dust and other substances avoided.

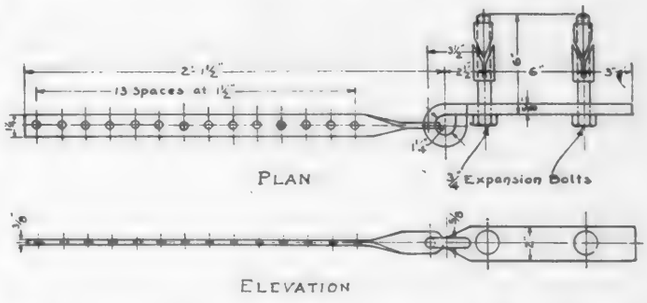
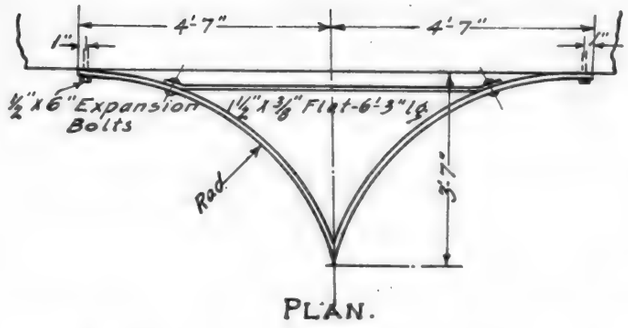


FIG. 2—DETAIL "A," VOLUME DEFLECTORS FOR CONCRETE BRANCH AIR DUCTS.

It is necessary to protect downpipes in shops from mechanical injury near the point where they enter the floor. Failure to do so will soon result in bent and damaged ducts. As shown in Fig. 9, a sheet-metal shield of heavy gauge is fitted snugly around the downpipe for a distance of 8 ft. above the floor. It is secured by 1/4-in. bolts at the front end and at the rear by 4-in. lag screws to the post, bolts and screws being on 10-in. centers. The space between the pipe and the shield is grouted for 3 in. above the floor line and sloped so as to drain towards the post. Shields are painted two coats inside and outside before erection.

In factories it may be desirable to install some simple screens (Fig. 10) for the discharge outlets of large size. An angle-iron frame with corner plates encloses a screen of 2 in. mesh No. 11 B. W. G. galvanized poultry wire.

Manholes for cleaning out and hand-holes or arm holes may be used to great advantage when finally adjusting the system. The necessary adjustments may



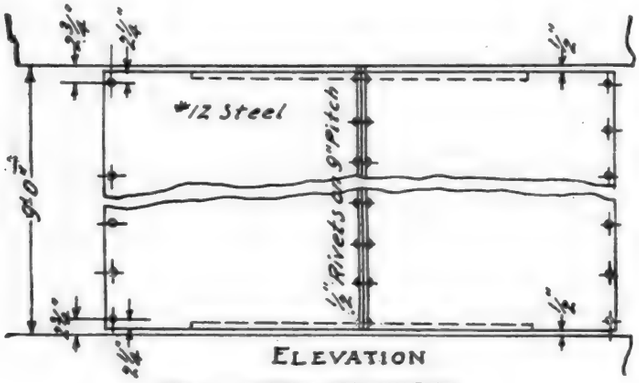


FIG. 3—DETAIL OF DIVIDER.

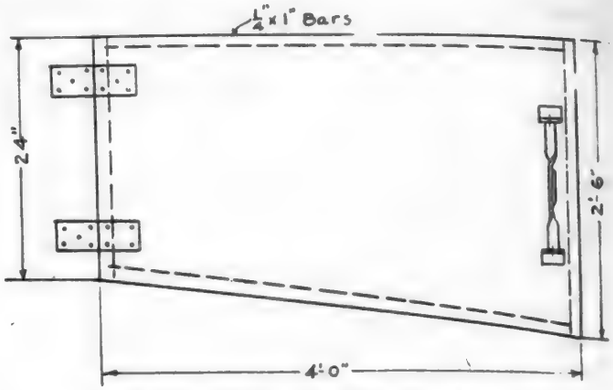


FIG. 5—DETAIL OF VOLUME DAMPER.

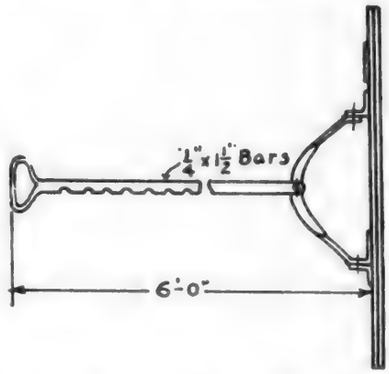


FIG. 6—DETAIL OF ADJUSTING BAR.

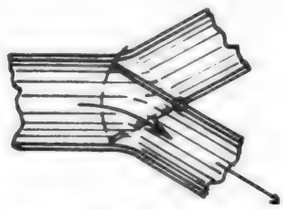
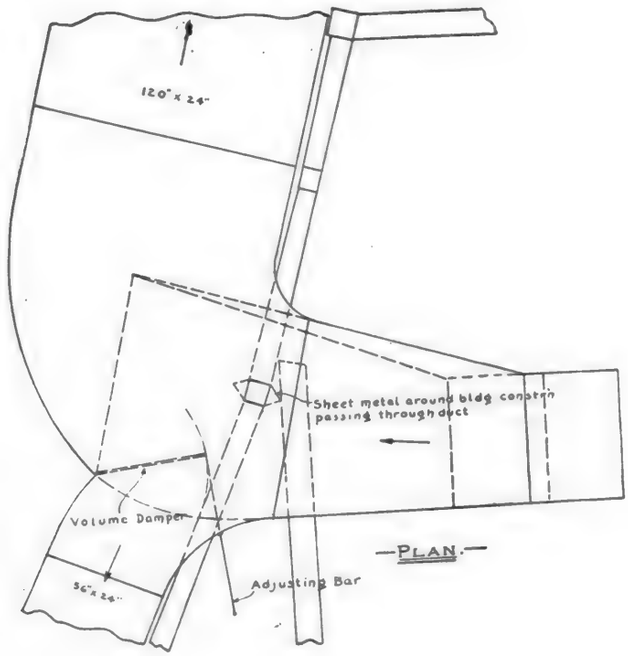


FIG. 7—ARRANGEMENT OF DEFLECTOR IN Y-SHAPED JUNCTION.



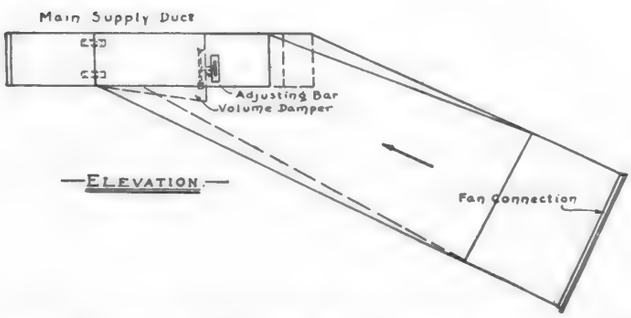


FIG. 4—VOLUME DAMPER IN OVERHEAD SHEET METAL DUCT.

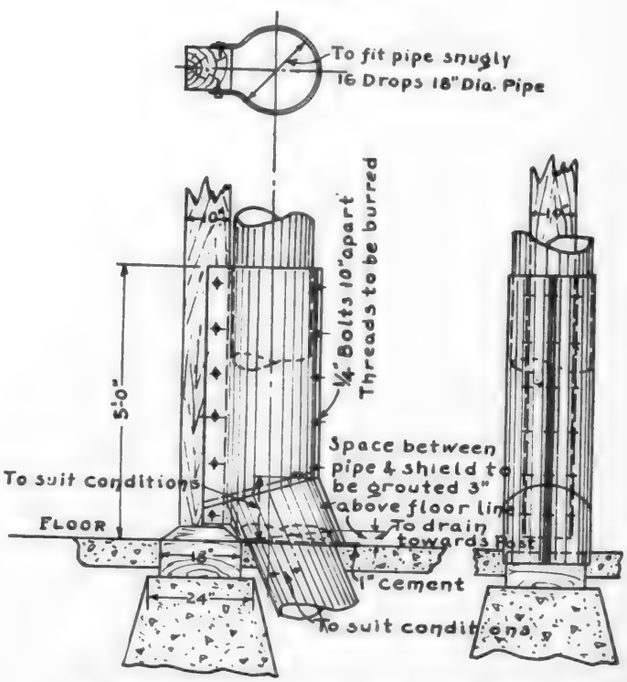


FIG. 9—DETAIL OF GUARD FOR DOWN PIPE.

be facilitated and the system quickly balanced, if intelligently designed, by the manipulation of dampers or deflectors through these holes. The general tendency

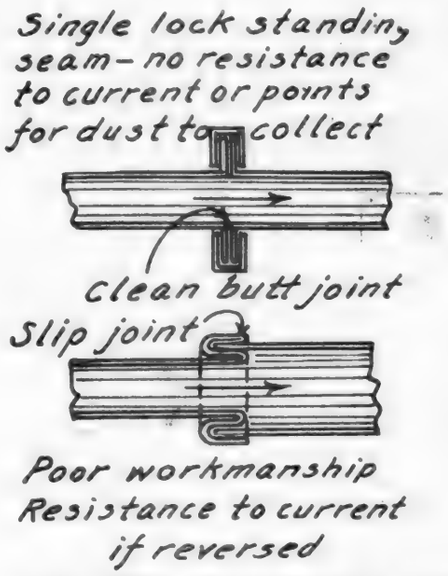

Single lock standing seam – no resistance to current or points for dust to collect
Clean butt joint
Slip joint
Poor workmanship
Resistance to current if reversed

FIG. 8—SLIP JOINTS ON SHEET METAL WORK.

is to leave out either or both hand-holes and deflectors, even though clearly specified and shown. The exact position of a damper or deflector may be quickly as-

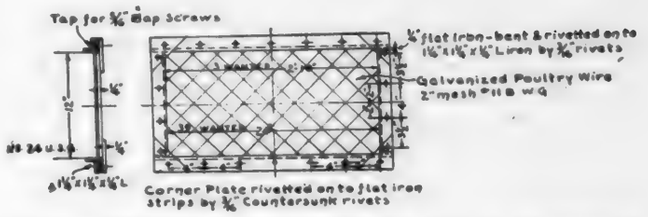


FIG. 10—SCREENS FOR OPENING OF DUCTS IN ENGINE PITS.

certained and may be more accurately known where hand holes have been installed adjacent thereto. Fig. 11 shows a hand-hole similar to the cover of a milk can, while it may also be made with a hinged lid and thumb-screw fastenings. Handholes which are opened

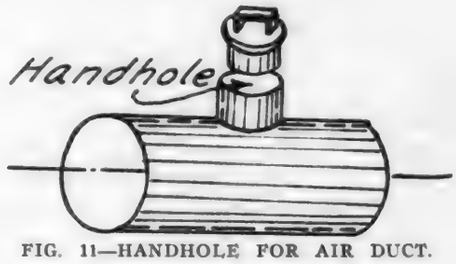


FIG. 11—HANDHOLE FOR AIR DUCT.

by means of a slide are generally unsatisfactory unless constructed of heavy material and frame. They are liable to buckle, stick, or fail to remain tight.

MODERN PRACTICE IN VAPOR HEATING

EDITOR'S NOTE: For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or thermograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.

XXII—THE DOODY SYSTEM.

Two characteristic features of the Doody system, manufactured by the Doody Vapor Heating Co., Inc., Boston, Mass., distinguish it from the other vapor heating systems described in this series. One is the Doody vapor regulator for controlling the boiler drafts which shows much ingenuity in its design, and the other is the Doody vapor vent placed on the radiator return valve itself and which not only takes the place of the ordinary air valve but also serves to admit moisture to the room air in an invisible jet.

Great importance is attached by the manufacturers to the adaptability of the vapor regulator (Fig. 5) for regulating the drafts and controlling the operation of the system. With this device, it is stated, regulation of the drafts is entirely automatic and exceedingly sensitive. The gauge glass indicates the amount of vapor in the system in ounces. The regulator is arranged with such control over the dampers in the smoke pipe and boiler draft door that a fractional movement of the dampers is secured from the full width to 1/4-in. opening. The attachment is described as so sensitive that this movement takes place as the rooms are warmed, as the radiator valves are turned on or off, and also with the variations of the outside temperature.

A typical layout of the Doody system is shown in Fig. 1. As the water in the boiler becomes heated, vapor rises from it and passes up into the supply pipes and radiators naturally. Through the use of the vapor vent on the radiator return elbow, there is no air resistance to the upward flow of the vapor. When the entire radiation is fully heated, condensation in the system is less rapid. This causes an excess of vapor to accumulate in the boiler sufficient to cause the vapor regulator to close the drafts. When this excess vapor is consumed the drafts again open, holding the boiler at the vapor point continuously.

The Doody modulating valve (Fig. 2), connected to the supply end of the radiator at the top, has a crescent-shaped port and a graduated dial with index to indicate the amount of opening of the port. It is of the quick-opening pattern, but has fractional adjustments; one-half turn of the handle opens or closes the valve fully.

The unusual construction of the Doody vented return elbow, shown in Fig. 3, deserves special attention. As will be noted, it is of very simple construction. The vent (in the side of a special sleeve) is intended to be open to the atmosphere at all times. It is well above the water of condensation, in a surface over which no water is flowing, so as to avoid leaks. The vapor vent itself is made in one piece with a small pinhole opening and has no moving parts. Incidentally, it is mentioned that these vents are supplied separate from the elbows to take the place of air valves on systems which are changed to vapor from water or steam.

Emphasis is laid on the advantage of this arrangement in providing a desirable amount of humidity to the rooms. The moisture that is given off, it is

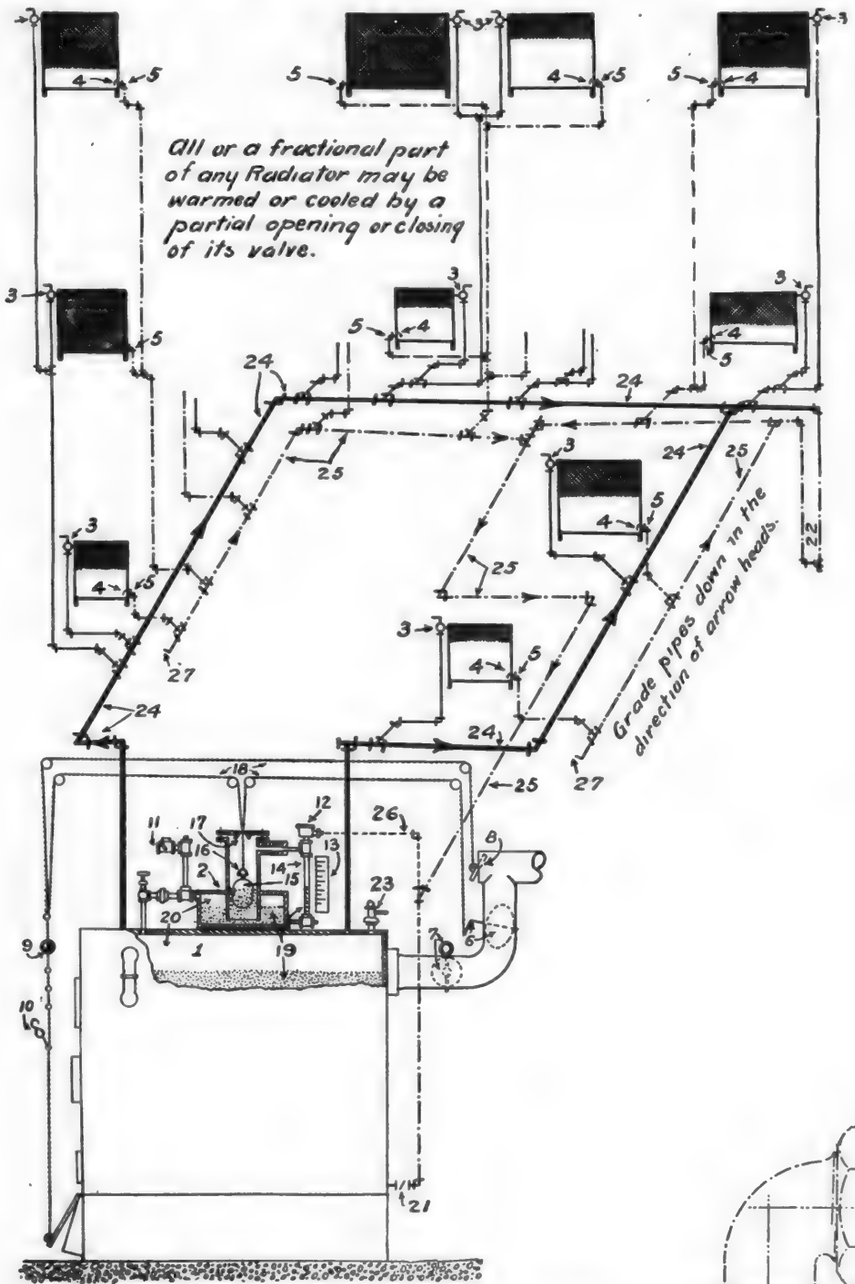

All or a fractional part of any Radiator may be warmed or cooled by a partial opening or closing of its valve.
Grade pipes down in the direction of arrow heads.

FIG. 1—TYPICAL LAYOUT OF THE DOODY SYSTEM.

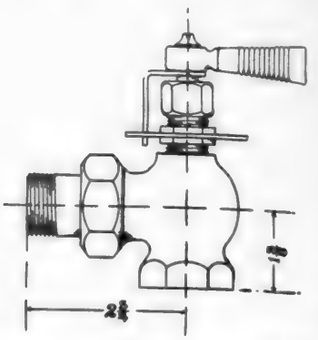


FIG. 2—DOODY MODULATING VALVE.

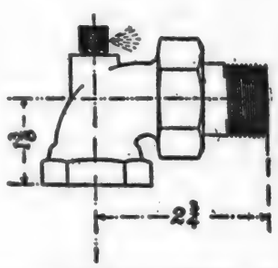


FIG. 3—DOODY VENTED RETURN ELBOW.

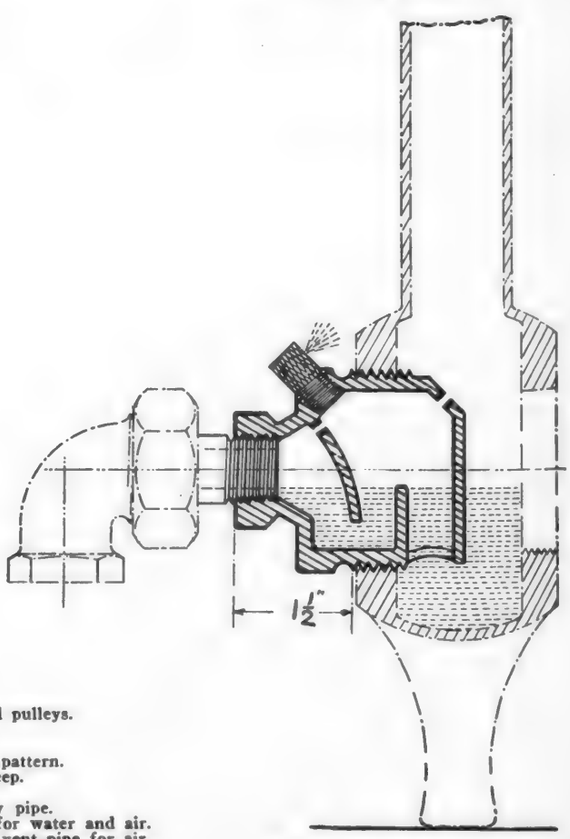


FIG. 4—DOODY DOUBLE-SEAL RADIATOR BUSHING.

1—Steam space in boiler above the water.
2—Doody vapor regulator for governing pressure.
3—Doody fractional radiator valves.
4—Double-seal radiator bushings (return traps).
5—Standard union elbow, water pattern.
6—Automatic damper (stands at 45 when closed).
7—Hand damper.
8—Check damper.
9—Counter weight, for opening cold-air check.
10—Hook for adjusting dampers or draft.
11—Vacuum breaker (¾-in. light swing-check valve).
12—Air eliminator (½-in. thermostatic trap).
13—Pressure scale graduated to read in ounces.
14—Gauge glass.
15—Float.
16—Floating valve.
17—Valve seat.
18—Damper chains and pulleys.
19—Water
20—Vapor.
21—Check valve, light pattern.
22—Loop seal, 3 ft. deep.
23—Safety valve.
24—Main vapor supply pipe.
25—Main return pipe for water and air.
26—Air line and open vent pipe for air.
27—Automatic vents for expelling air.

added, is found to be free from odors because of the fact that the vent is continuously open.

Another point made in the use of this system is that it may be readily applied to either one or two-pipe steam heating systems already installed, with few changes in the piping. To make this change it is not necessary to draw fires or blow off boilers.

REQUIREMENTS FOR INSTALLATION.

Among the requirements for the installation of this system are that the boiler should have a large steam space above the water-line. Two light, free-working dampers should be provided, one in the smoke pipe and the other in the boiler-draft door. Both dampers should close by gravity and be connected to the vapor regulator by brass chains running over pulleys not less than 3 in. in diameter. Connection of the vapor regulator to the steam space of the boiler should be made by a 3/4-in. pipe pitching toward the boiler.

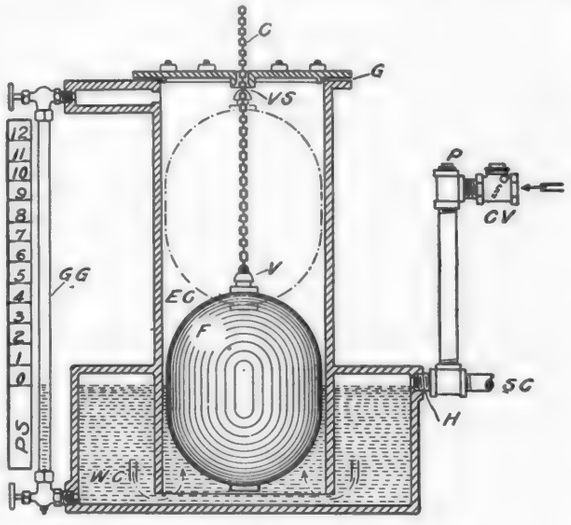


FIG. 5—DOODY VAPOR REGULATOR.

WC—water chamber. F—float. V—valve carried by float. GG—gauge glass. PS—pressure scale in ounces. SC—steam connection leading to steam chamber of boiler (above water-line. H—high point in the piping. CV—swing check valve for breaking vacuum. P—plug for filling regulator with water.

The radiators should be of the water type, tapped 3/4-in. inlet at the top and 3/4-in. outlet at the bottom, opposite ends. It is recommended that as much pitch as possible be given to the main supply pipes. When graded upward from the boiler, this pitch should be not less than 1 1/2 in. in 10 ft. If mains are reduced in size when pitching downward, an eccentric fitting should be used to keep the main free from water.

Return pipes from the radiators should be connected below the water-line of the boiler in the return main.

Water-Hammer Action

In an article explaining the principles of water-hammer action, which, it is shown, can exert a pressure as high as 2049 lbs. per square inch in a given boiler, a writer in the Sanitary Engineer (Toronto, Can.) emphasizes the fact that it is of exceeding importance, in cutting in a boiler, to be sure that the pressure upon it is as nearly identical as possible with the pressure which is prevailing, at the time, in the steam main. Mathematically, equality can hardly ever be attained, however, partly because commercial steam gauges will seldom agree to within a pound or so. Hence when the equality of pressure is judged to be exact, the stop-valve should be opened very carefully, indeed opened just a bare crack at first, and then, as the slight outstanding difference of pressure equalizes itself, opened wider, very slowly, until it is open full. The complete operation should occupy a couple of minutes or more, and the attendant should hold himself in readiness, at every instant, to close the valve at once, if there is the slightest evidence of any unusual jar or disturbance of any kind, about the boiler.

CORRESPONDENCE

Chimney Data.

EDITOR HEATING AND VENTILATING MAGAZINE:

I was pleased to note the information on stacks which was presented at a recent meeting of the Western New York Chapter of the heating engineers' society and published in your December, 1919, issue. It agreed very closely with the Standard Data Sheets you have published on chimneys. The friction loss is calculated the same way. In the matter of stack friction, however, Mr. Harding assumes this friction not as 0.2 in. per 100 ft. of height, but at 0.1 in. This, the writer believes, would not be the most economical loss, for 0.2 in. means a slightly higher stack, but less diameter all the way up.

In connection with the results obtained by chimneys of certain heights and diameters when connected to a given amount of radiation, Mr. Harding does not state what would happen if the chimneys were higher or lower than that given. For instance, I have a building with 10,000 sq. ft. of E. D. R. (steam). According to Mr. Harding's data, a stack 32 in. x 32 in. square, or 34-in. in diameter, will serve if it is 80 ft. high. Let us suppose that the height of the building determines that the stack must go up 110 ft. to clear the top, or suppose that we are limited, for some reason, to 60 ft. in height What would be the size of the chimney in that case?

According to the Harding figures, if we assume a cast-iron sectional boiler, burning anthracite egg coal at 8.6 lbs. per square foot of grate burned, we get draft losses as follows:

Fire	0.07 in.
Boiler (100%)	0.15 in.
20 ft. of flue	0.03 in.
Two 90° turns	0.10 in.
Stack (assumed) 0.10 x 80 ft. high	0.08 in.
	0.43 in.

Temperature of stack gases, 550°.

550° = 0.0071 in. draft per foot.

0.0071 × 0.75 = 0.0053 in. theoretical draft per foot.

0.0053 × 80 = 0.4240 in. theoretical draft for 80 ft.

This shows that at 80 ft., the height is correct, as it gives a theoretical draft which just about

· CHIMNEY DATA ·

The following table for area and height of chimney has been used with success in a large number of heating installations.

Capacity of Boiler. Sq. ft Direct Steam Radiation.	Square Flue Inches.	Round Flue Diam. Ins.	Height Chimney Above Grate.
Up to 500	9	10	40
500 - 1000	12	13	45
1000 - 1500	12	13	50
1500 - 2500	16	17	60
2500 - 3000	20	22	60
3000 - 3800	20	22	70
3800 - 4200	20	22	75
4200 - 6500	24	26	75
6500 - 8750	24	26	80
8750 - 10000	28	30	80
10000 - 10500	32	34	80
10500 - 13000	32	34	90
13000 - 14000	36	38	90

The equivalent B.H.P. rating of above chimneys is; Sq. ft. rating x .00725.

For large installations and for power boilers the draft losses should be estimated and a height of chimney chosen to give an intensity of draft sufficient to balance the sum of the losses. See data following

Draft Loss Through Fuel Bed. (Ins. water.)

Fuel.	Rate of combustion lb per Sq. ft. grate surface per hour.				
	5	10	15	20	25
Anthracite	.06	.16	.30	.45	.65
Pea		.07	for 8.6 lb. Comb rate		
Egg					
Bituminous					
Semi-Bituminous	.05	.10	.18	.26	.35
Penna., Ill., Ala., Ind	.04	.09	.15	.22	.28
Slack	.04	.07	.10	.15	.20
Run of mine	.04	.05	.06	.10	.14
Chain Grate	.05	.12	.15	.23	.31

Loss of draft through boilers operating at normal load

Return Tubular	0.25"
Hor. Water Tube	0.35"
C.I. Sectional	0.15"

For 150 % rating add 50% to above losses.

Loss through steel breeching 0.15" per 100 ft. and 0.05" for each right angle turn. Loss through stack approx. 0.10" per 100 ft. height.

THEORETICAL DRAFT PRODUCED BY CHIMNEYS PER FOOT OF HEIGHT.

330° F. Temp. flue gas. = .0053" 500° F Temp flue gas. = .0067"
400° F " " " = .0058" 550° F " " " = .0071"
450° F " " " = .0063" 600° F " " " = .0075"

Use .75 of above values to allow for cooling of the gases

· CHIMNEY DATA · (CONT'D.)

AREA CHIMNEY REQUIRED — Sufficient area to pass the gases will be provided by using the following formula.

Inside area at top, Sq. ft. $(A) = \frac{.06C}{\sqrt{H}}$

C = Lbs. coal burned per B.H.P and H = Height of chimney above grate in feet.

Assuming 5 lbs. coal per B.H.P., $A = \frac{.3\ B.H.P.}{\sqrt{H}}$.

If R = Sq. ft. rating of steam heating boiler, Then $A = \frac{.0022R}{\sqrt{H}}$

Breechings for power boilers should be proportioned on a basis of 35 sq. ft. area per 1000 B.H.P.

EXAMPLE:— Required area and height of chimney for an installation of 2 - 150 B.H.P. return tubular boilers with a chimney of sufficient height to operate boilers at normal rating burning slack, breeching 50 ft. long with one right angle turn Grate area = 60 sq. ft. Rate comb'n. based on 5 lbs. coal per B.H.P = $\frac{5 \times 300}{60}$ = 25 lbs. per sq. ft.

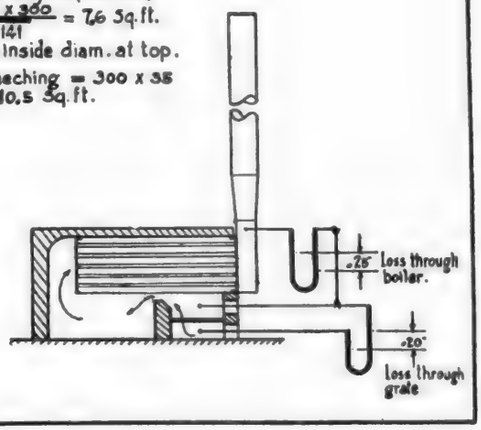
Solution —

Loss through grate.	= 0.20"
" " Boiler.	= 0.25"
" " Breeching	= 0.075"
One right angle turn.	= 0.05"
Stack loss (estimated.)	= 0.19"
Total =	0.705"

Assume flue temperature of 500°
Draft per ft. of height is approx.
.75 · x .0067 = .005".
∴ Height of chimney required is;
$\frac{0.705}{.005}$ = 141 ft.

Area of chimney required is;
$A = \frac{.3 \times 300}{\sqrt{141}}$ = 7.6 Sq. ft.
or 3.1 ft inside diam. at top.

Area of breeching = 300 x 35 ÷ 1000 = 10.5 Sq. ft.



THE HARDING CHIMNEY DATA SHEETS.

equals the required draft which we have computed. If we used pea coal, the fire loss is increased 0.16 — 0.07 = 0.09 in., making the total loss 0.43 + 0.09 = 0.52 in., or so exceeding the theoretical draft produced as to be unsafe. This would make it seem that the Harding table is correct only for egg coal and would not do for either pea or buckwheat coal.

For area, Mr. Harding states that (R x 0.0022) ÷ √H = area when R is equivalent direct radiation and H is the height of the stack in feet. In our case R = 10,000 sq ft. and H = 80 ft. Then 0.0022 R ÷ √80 = area in square feet. (10,000 × 0.0022) ÷ 8.94 = 22 ÷ 8.94 = 2.46 sq. ft., say, 2 1/2 sq. ft. The square feet of the flue equals 32 (32 x 32) ÷ 144 = 7 1/9 sq. ft. This gives 7 1/9 sq. ft. area in the table against 2½ sq. ft. calculated from the formula, unless the instructions have been misunderstood at some point.

In the example used by Mr. Harding, it is calculated that it will take a 141-ft. chimney to produce 0.705 in. of draft. By the same figuring it would require 1 ÷ 0.005 = 200 ft. chimney to produce 1 in. of draft. We have all seen chimneys where the requirements are 1 in. or 1 1/8 in. and these chimneys do not run much above 100 ft. in height, say, 110 ft, to 125 ft. Is there not something wrong in this, for, according to the theoretical draft chart shown in your Standard Data Sheet No. 100-E, a chimney 140 ft. high will give 1.22 in. of draft on a zero day, and slightly less in ordinary weather.

Checking the heights given by Mr. Harding for 10,000 sq. ft. 80-ft. chimney by your Standard Data Sheets, we find the following:

Fire loss	0.07 in.
Boiler	0.25 in.
Flue	0.02 in.
Bends	0.10 in.
Chimney (per 100 ft.)	0.20 in.
Contingencies	0.10 in.
	0.74 in.

By the theoretical draft data sheet (No. 100-E) we find that at sea level a stack 85 ft. high will give

0.74 in. As our stack loss is on 0.2 in. per 100 ft., an 85-ft. stack will have a loss of $85 \times 0.2 = 0.17$, or 0.03 in. less. $0.74 - 0.03 = 0.71$ in. actually required, and by the same chart this is an 80-ft. stack. So far as heights go, the two methods agree perfectly.

According to your stack tables for area, there would be about 1 1/2 lbs. of gas per second for 10,000 sq. ft. and the size flue would be about 22 in. in diameter, or $(22 \times 22 \times 0.7854) \div 144 = 2.64$ sq. ft. This checks quite closely with the Harding formula giving 2 1/2 sq. ft. area, but not with the Harding table requiring 7 1/9 sq. ft. area. It should be remembered, however, that in the Harding formula he uses a stack loss of 0.10 in. per 100 ft. and if we size the stack on this basis we find, by your Data Sheet tables, that the area must be about 36 in. diameter, or 7.06 sq ft. making the Harding table agree with the Data Sheets, but not his formula.

This loss of 0.10 in. per 100 ft. in the stack will allow us to reduce the height if we use a 36-in. diameter stack, for our friction losses then become:

Fire loss	0.97 in.
Boiler	0.25 in.
Flue	0.02 in.
Bends	0.10 in.
Chimney (per 100 ft.)	0.10 in.
Contingencies	0.10 in.
	0.64 in.

or a 75-ft. stack.

$75 \times 0.10 = 0.075$, say, 0.08.

$0.10 - 0.08 = 0.02$.

$0.64 - 0.02 = 0.62$ true friction loss = 70-ft. stack

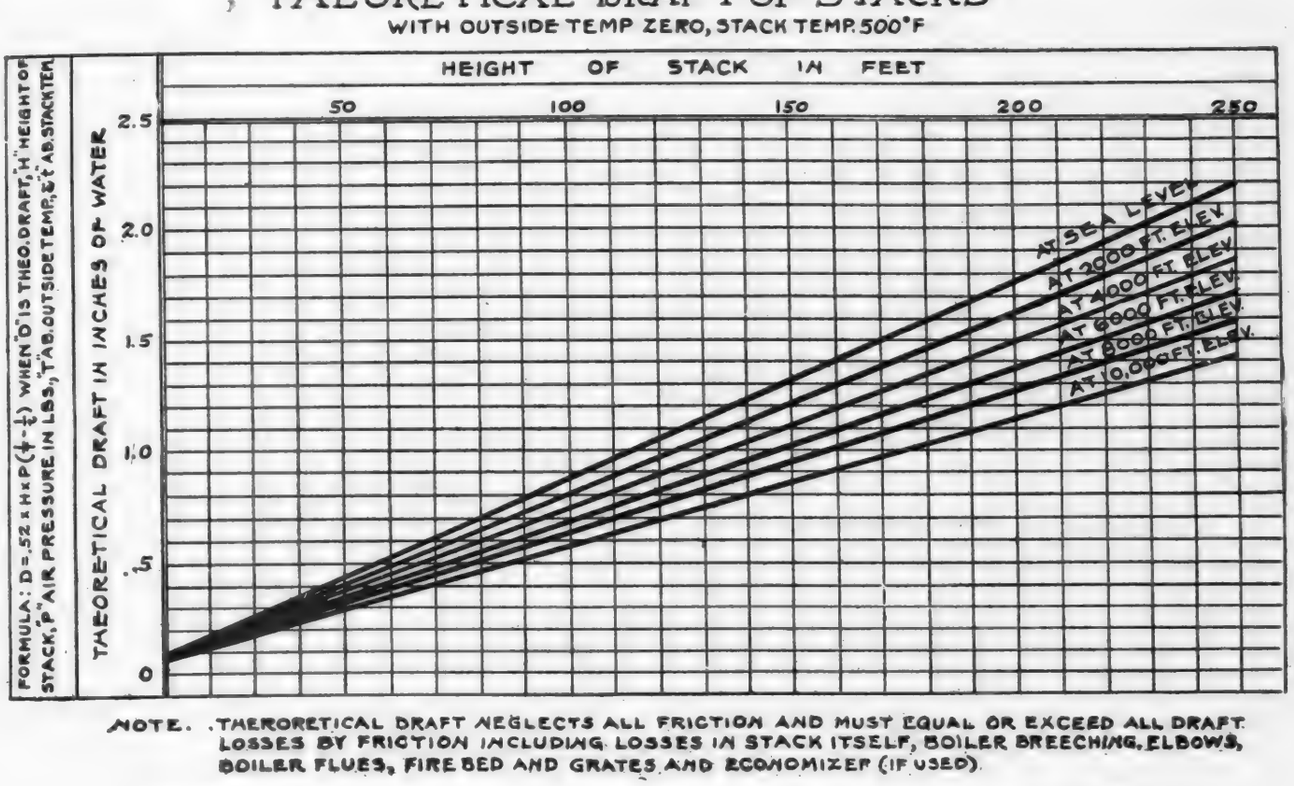
This leaves us a 70-ft stack 36-in. diameter, or a 80-ft. stack 22-in. diameter, or any combination between these two extremes. This means that the 36-in. stack so reduces the stack friction that 10 ft. can be cut off the height, but in actual construction, this 10 ft. will not pay for the increase in diameter, for we have almost doubled the circumference and material to save 12 1/2% on the height.

New York. A. L. H.

LEGAL DECISIONS

Seasonal Heating Charges

In authorizing a minimum seasonal charge of $1.00 per month, in addition to service charge to West Bend Heating & Lighting Co., the Wisconsin Commission said: "The question of a seasonal minimum charge was introduced by the utility and merits attention. There are certain expenses connected with the operation of the plant which continue, whether the consumer uses any steam or not. The fact that the utility must be ready at all times to supply the service to the consumer up to his maximum capacity would necessarily imply, it seems, that the consumer should be assessed a portion of the fixed or capacity expenses in the form of a service charge or properly designed minimum charge. Included in this charge should be such consumer costs as reading meters, delivering bills, customers' premises expenses, maintenance of service and meters, etc. Where the service charge is too low to cover these expenses one of two things must happen in case a consumer uses little or no steam for any given period. Either the plant must lose the amount of the 'consumer' and 'capacity' expenses for that


THEORETICAL DRAFT OF STACKS
WITH OUTSIDE TEMP ZERO, STACK TEMP. 500°F
HEIGHT OF STACK IN FEET
50
100
150
200
250
THEORETICAL DRAFT IN INCHES OF WATER
2.5
2.0
1.5
1.0
.5
0
AT SEA LEVEL
AT 2000 FT. ELEV.
AT 4000 FT. ELEV.
AT 6000 FT. ELEV.
AT 8000 FT. ELEV.
AT 10,000 FT. ELEV.
FORMULA: D = .52 × H × P (1/T − 1/T') WHEN 'D' IS THEO. DRAFT, 'H' HEIGHT OF STACK, 'P' AIR PRESSURE IN LBS., 'T' AB. OUTSIDE TEMP., 'T'' AB. STACK TEM.

NOTE. THEORETICAL DRAFT NEGLECTS ALL FRICTION AND MUST EQUAL OR EXCEED ALL DRAFT LOSSES BY FRICTION INCLUDING LOSSES IN STACK ITSELF, BOILER BREECHING, ELBOWS, BOILER FLUES, FIRE BED AND GRATES AND ECONOMIZER (IF USED).

THE HEATING AND VENTILATING MAGAZINE THEORETICAL DRAFT DATA SHEET NO. 100-E.

period, or rates for steam sold to other consumers must be high enough to pay such expenses of the consumer who pays nothing. There are expenses which are continuous. They do not cease with temporary cessations in the use of steam, delay in turning on the steam in the fall, or curtailment of its use in the spring. The expenses of operation, which include those which exist twelve months of the year, must be covered during the eight months or possibly nine months of the heating season."

Recovery for Heating and Ventilating Apparatus Installed in States Other than Place of Contract.

Under the interstate commerce clause of the Federal Constitution, the Missouri Supreme Court holds, Hess Warming & Ventilating Co. v. Burlington Grain Elevator Co., 217 S. W. 493, that an Illinois ventilating company, without taking out a license to do business in Missouri under the statutes of that State, could contract in Chicago for the installation of ventilating apparatus which was constructed in Chicago, shipped to a purchaser in Missouri, and there installed under the seller's supervision by workmen hired in the vicinity merely for the purpose and temporarily. The ventilating company obtained judgment against a grain elevator company, on its claim for the installation of grain-drying apparatus. No appeal was taken therefrom. It was held that the ventilating company's right to maintain the action was conclusively established by the judgment, and the elevator company, is successor, and other creditors, could not inquire into the legality of the judgment in a subsequent collateral proceeding by the ventilating company to set aside certain conveyances of the elevator company.

Service Charges—Excess Equipment.

There is a wide difference in the use of steam by various customers. The Missouri Public Service Commission therefore holds, in authorizing the Springfield Gas & Electric Company to put in force a schedule of increased steam heating rates, that steam heating charges should be divided so that each customer should pay a fixed charge that will take care of the investment necessary to provide for his demands, this charge being in addition to the cost of supplying the steam used. If the system is larger than the present demand, but not too large for reasonable and probable growth, the fixed charges on the extra plant investment should be absorbed in the rates for energy. This is fair, because the extra equipment is not put in for any particular customer, but to avoid the excessive cost of increasing the system as the load increases in the future.

After studying the situation of the company, the commission concluded that it would have to forego all profit in the business and work to reduce the loss in operation. Rates high enough to enable the company to realize a return on the investment would probably cause some of its customers to operate their own heating systems, thereby increasing the company's losses.

In this case there was not only evidence tending to show acceptance, but the evidence on that point was practically conclusive. The president of the defendant company was present practically every day while the work was going on. He knew that the number of square feet of radiation called for by the contract was not being installed, for the president of the plaintiff company discussed this with him, told him that in his judgment the amount mentioned in the contract was more than was necessary, and they talked about what would be a proper allowance for the omitted part. It did not appear that any complaints were made until after the work had been accepted and was being used. When the contractor is in default, so that he cannot sue upon his contract, but the other party has stood by and seen him prosecute the work without objection, and been benefited by his labor and materials, there has been an implied acceptance, and the contractor is entitled to compensation to the extent of such benefit. The law in such case implies a promise to pay what the labor was reasonably worth, of which the special contract will furnish evidence.

The jury might have found for the plaintiff on either of two theories: (1) That of substantial performance by the plaintiff and acceptance by the defendant, due allowance being made for defects and deviation. On this theory, the contract price would be the standard for the measure of damages; (2) that there was not a substantial performance by the plaintiff, but the deviations from the contract were made in good faith, and the work was accepted by the defendant and used by him. On this theory the measure of damages would be the reasonable value of the work, not exceeding the contract price.

A Cold-Proof House.

Much interest has been aroused through a description published in *Concrete* of a house in Saskatoon, western Canada, built by a refrigeration engineer and designed to be "cold-proof." It is stated that so much care has been taken by the builder, H. Gauvin, to insulate the walls, that he has been able to use electric heating without undue cost. It is further stated that the cost of the "cold-proof" insulation was not 10% more than the cost of the ordinary tight construction.

The house itself is built of pebble-dash stucco for the walls and tar and gravel for the roof. There are nine rooms, with total contents of 20,000 cu. ft. There are 43 windows, but only two outside entrances. A concrete basement extends under the entire house, and includes a concrete tank for soft water.

The outside walls are built on 8-in. studs. Centered on the outer edge of each stud is a 5/16-in. steel rod, to which metal lath is attached, thus keeping the metal lath away from actual contact with the edge of the stud. The outer coat of cement plaster and stucco was applied to the metal lath to a thickness of 3/4-in. When this had hardened, back-plaster was applied between the studs. This back-plaster filled in between the edge of the stud and the metal lath, in the space provided by the vertical rods. The outer section of the wall then consists of a reenforced concrete slab 1 1/2 in. thick, attached to the studs.

When the back-plaster had hardened and dried, the entire back-plaster and faces of the studs were given a coat of hot pitch, each pair of studs and wall space between forming three sides of an air-tight vertical pocket.

The inner section of the wall was built up as follows: Two layers of asphalt paper tacked to the inner edges of the studs. On top of the paper, ordinary wooden lath and plaster finish.

The air-tight spaces thus left between the studs were then filled with insulating material consisting of granulated cork mixed with 10% of dry planer shavings. ... The idea was not to pack this material into a solid mass, but to give it sufficient density to prevent the circulation of air through the mass, and at the same time leave a fairly uniform distribution of minute air pockets.

PREVENTING COLD AIR FROM ENTERING AT LOWER FLOOR LINE.

The greatest care was taken to prevent entrance of cold air at the lower floor line and to prevent the escape of warm air through cracks or other apertures under the eaves. In ordinary construction it is common to bring the floor sleepers out flush with the outside surface of the concrete foundation. Slight shrinkage of the wood leaves a crack on each side of the sleeper, through which cold air may enter. In this instance the sleepers were not brought out to the surface, so that the outer face of the foundation is smooth concrete. An additional precaution was taken by painting the ends of the sleepers with hot pitch to prevent absorption of water from the concrete and consequent shrinkage. The stucco surface was carefully brought to an air-tight joint with the corner edge of the foundation.

The roof is flat, pitching slightly toward a central rain-pipe, which leads into a basement water tank. The roof rafters are 15 in. in depth. After the ceiling had been nailed up, the spaces between the rafters were filled with the cork and shavings insulating mixture to a depth of 15 in., the rough roofing was laid, and finished off with an ordinary tar and gravel composition. The roof framing was the simplest and most inexpensive that could be devised to meet the conditions.

ALL DOORS AND WINDOWS WEATHER-STRIPT.

It is obvious that if the greatest economy in heating during severe weather is to be secured, no cold air must be permitted to enter the house, except that actually required for ventilation. To secure this economy all doors and windows are weather-stript with metal. There are only two entrances, one front and one in the rear. Both are double entrances, that is, a small entry-way or vestibule is provided, and one door is closed before the other is opened, thus preventing a rush of cold air into the house.

The window sashes were made as nearly air-tight as possible. The window casings were made of material and were rabbeted at the joints, each piece being primed separately to avoid shrinkage. The open spaces between the walls and frames were packed with mineral wool, and every crack was made air-tight. When storm-windows were fitted they were pushed snugly against felt strips. The result is that although there are 43 windows in the house, it is as snug as an underground cave, and the wind does not "drive the heat out" of the northeast bedroom. We read further:

"The first floor is filled with insulating material between the basement ceiling and the rought flooring, and the second floor is also insulated for 4 ft. around the outer wall. .....

"Tests in heat transmission through walls show that ordinary 'double frame' wall, consisting of 8-in. studs, covered on the outside with double sheeting, and on the inside sheeted, papered, lathed and plastered, transmits 8.10 B. T. U. per square foot per twenty-four hours for each degree of difference in the temperature. In comparison with this, the type of wall construction used in Mr. Ganvin's house transmits only 1.9 B. T. U. less than one-fourth —under the same conditions.

"The saving of fuel from this source alone is very considerable, but the construction was made much more effective by the elimination of convection currents, which in ordinary frame houses permit the heat to trickle through the roof.

USE OF ELECTRIC STEAM RADIATORS.

"The heating plant consists of nine electric steam radiators These are ordinary steam radiators with an electric heating coil inserted in the lower manifold. It has been found that it is not necessary to keep all the radiators going in order to keep the house comfortably warm, even in extremely cold weather.

"At two and one-quarter cents per kilowatt-hour, the bill for October was $8.32; for November, $25.-76, and for the first twelve days of December, $19.-18. These figures compare very favorably with the amount spent for coal in heating an ordinary house of equivalent size.

"The radiators are turned off every night about 8:30. Even when the outside temperature reached 35° F. zero, as it did December 9, the inside temperature next morning had fallen only to 54°.

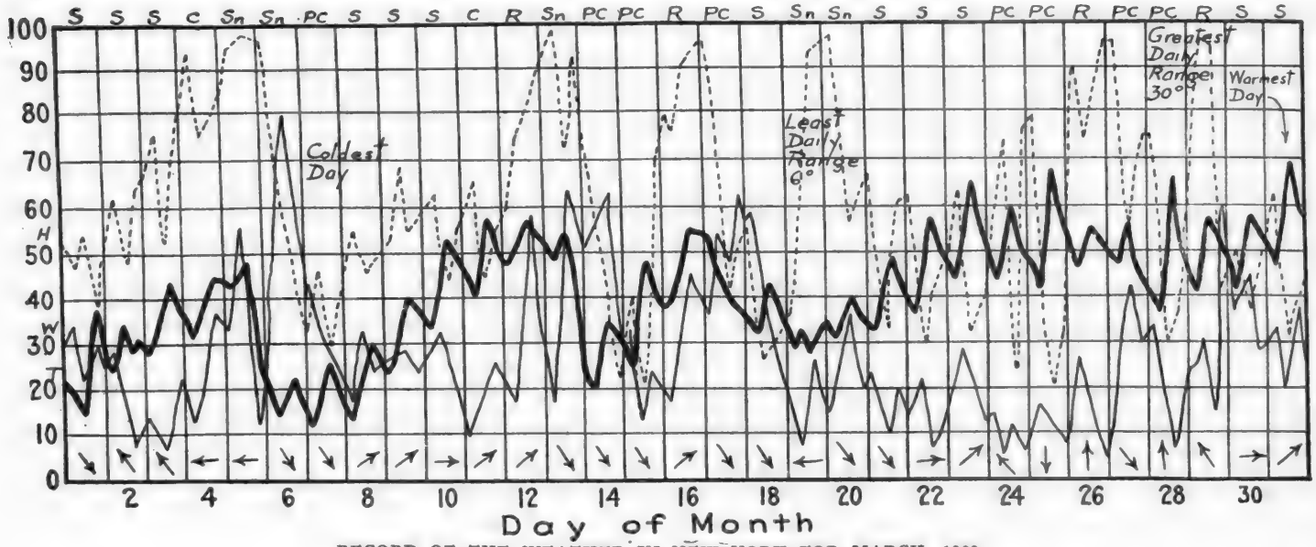
"This type of construction is, of course, as well adapted to any other heating system as to this one, but it was thought that the convenience of electricity might be taken advantage of, since its cost was not likely to be unduly high. The electrical installation was made at a first cost of about thirty-five per cent of what a steam installation would have cost."

TABLE OF TEMPERATURES INSIDE AND OUTSIDE

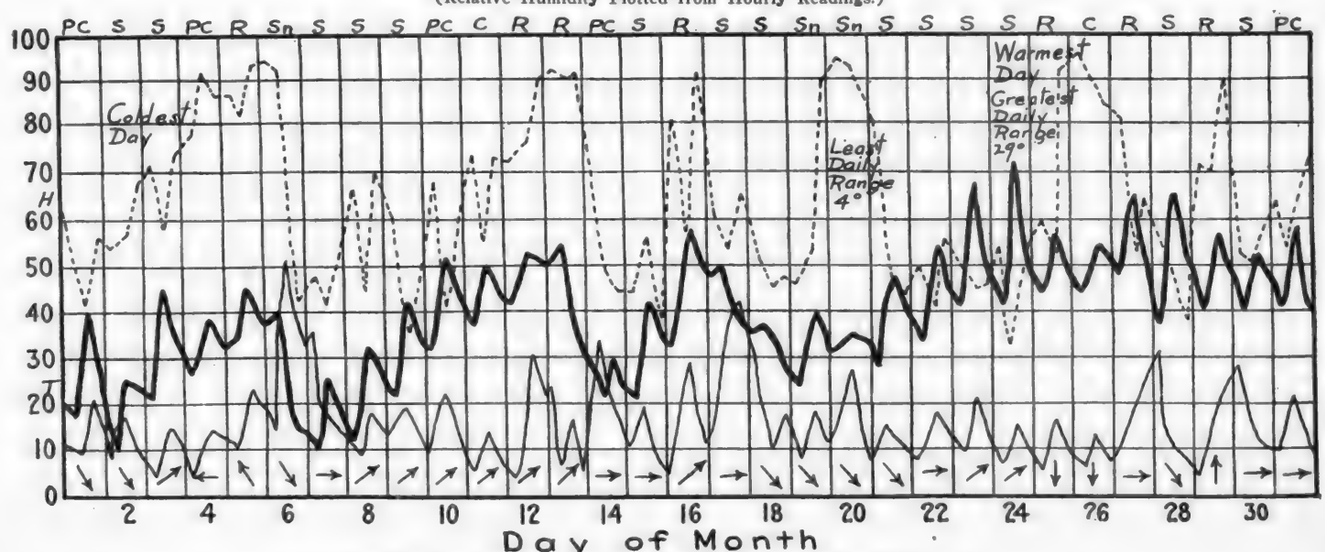
Date	Outside Degrees F.	Inside Degrees F.	Date	Outside Degrees F.	Inside Degrees F.
November			November		
1	18	64	23	10	67
2	16	67	24	6 below	66
3	16	66	25	4 below	67
4	14	65	26	6 below	67
5	6	66	27	0	68
6	0	67	28	4	68
7	10	65	29	12 below	67
8	5	66	30	16 below	67
9	10	68			
10	4	65	December		
11	4	66	1	10 below	66
12	8 below	65	2	6 below	67
13	0	65	3	4	68
14	20	67	4	14	67
15	30	68	5	10	68
16	42	68	6	20 below	67
17	30	68	7	20 below	67
18	32	66	8	22 below	66
19	38	68	9	24 below	67
20	30	67	10	22 below	66
21	34	68	11	24	66
22	36	66	12	6	67

THE WEATHER FOR MARCH, 1920

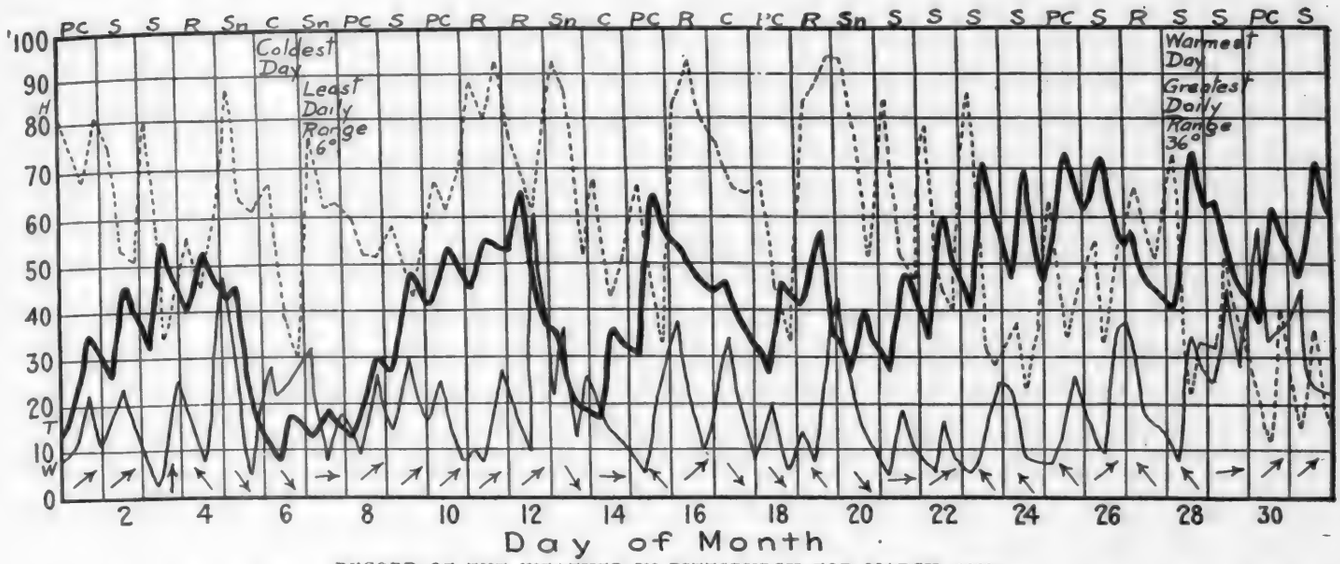
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	69	72	73	73	80
Date of highest temperature	31	24	28	31	27
Lowest temperature, degrees F.	12	10	9	3	7
Date of lowest temperature	7	2	6	7	7
Greatest daily range, degrees F.	30	29	36	26	31
Date of greatest daily range	28	24	28	12	8
Least daily range, degrees F.	6	4	6	4	7
Date of least daily range	19	20	7	18	24
Normal temp. for month, degrees F.	40.6	39	42.6	40	46.6
Normal mean temp. for month, deg. F.	37.5	35	39.5	34.4	43.5
Total rainfall, in.	4.16	3.72	1.77	4.57	3.97
Total snowfall, in.	5.7	11	3.1	3.3	1.5
Normal precipitation, this month, in.	4.1	4.08	3.01	2.55	3.43
Total wind movement, miles	16793	9491	11519	12414	15045
Average hourly wind velocity, miles	22.6	12.8	15.5	16.7	20.2
Prevailing direction of wind	N. W.	S. W.	S. W.	S.	S. W.
Number of clear days	12	14	10	14	15
Number of partly cloudy days	9	8	8	6	6
Number of cloudy days	10	9	13	11	10
Number of days on which rain fell	4	7	10	14	8
Number of days on which snow fell	5	3	4	3	1
Snow on ground at end of month, in.	None	None	None	None	None



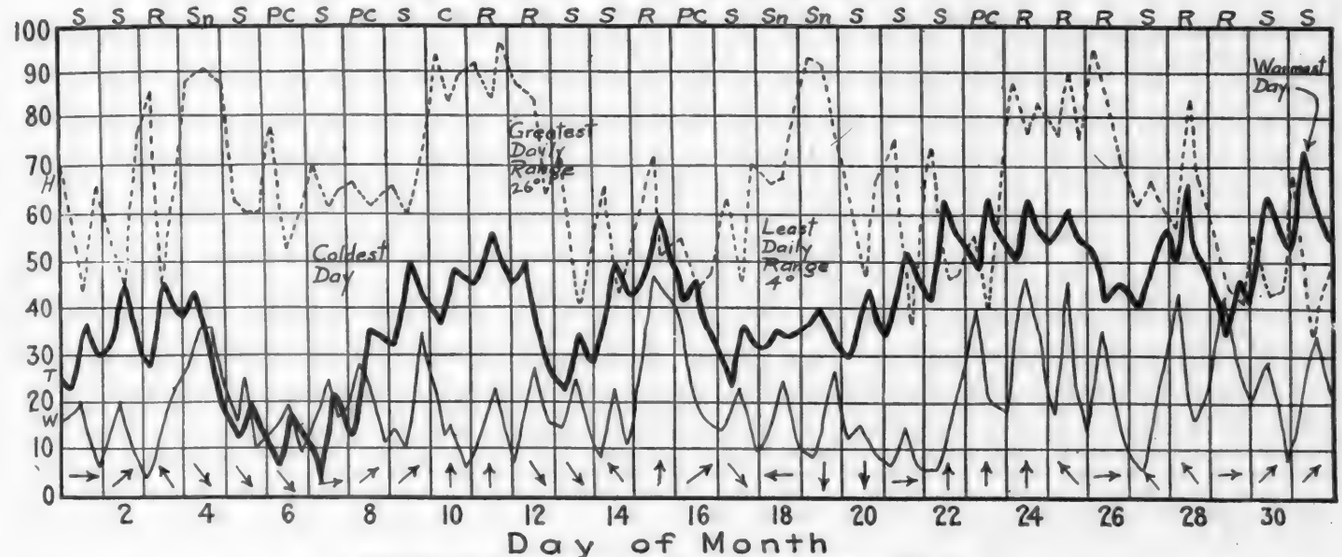
RECORD OF THE WEATHER IN NEW YORK FOR MARCH, 1920.
(Relative Humidity Plotted from Hourly Readings.)



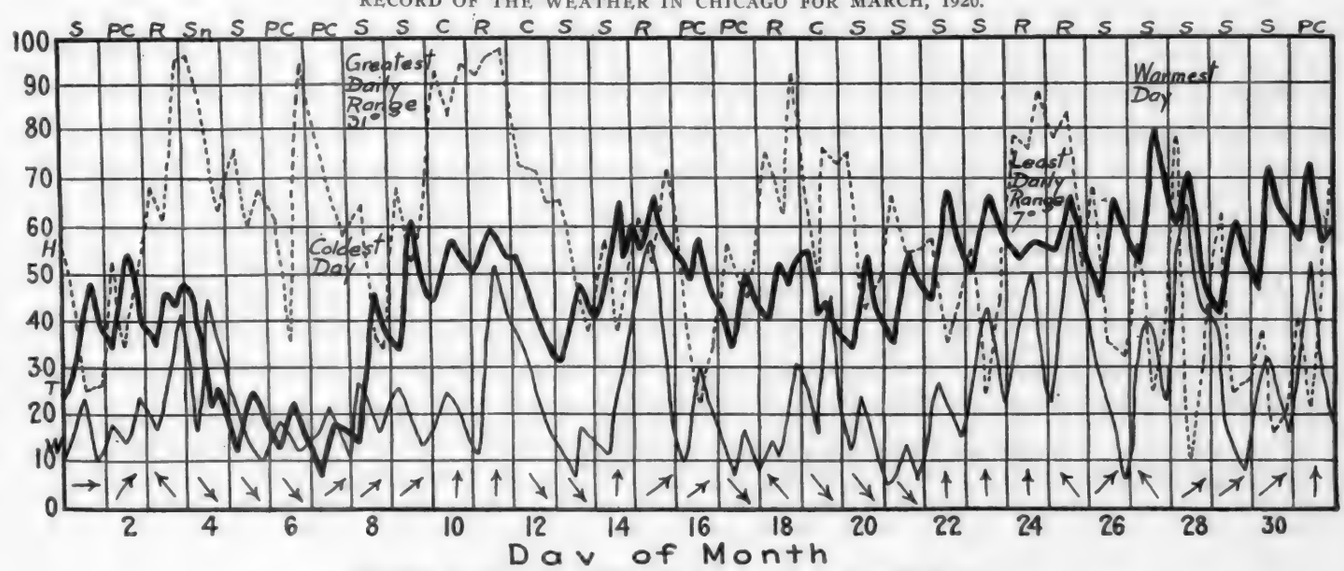
RECORD OF THE WEATHER IN BOSTON FOR MARCH, 1920.


PC S S R Sn C Sn PC S PC R R Sn C PC R C PC R Sn S S S S PC S R S S PC S
Coldest Day
Least Daily Range 6°
Warmest Day
Greatest Daily Range 36°
H
T
W
0 10 20 30 40 50 60 70 80 90 100
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR MARCH, 1920.


S S R Sn S PC S PC S C R R S S R PC S Sn Sn S S S PC R R R S R R S S
Greatest Daily Range 26°
Warmest Day
Coldest Day
Least Daily Range 4°
H
T
W
0 10 20 30 40 50 60 70 80 90 100
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR MARCH, 1920.


S PC R Sn S PC PC S S C R C S S R PC PC R C S S S S R R S S S S S PC
Greatest Daily Range 31°
Warmest Day
Least Daily Range 7°
Coldest Day
H
T
W
0 10 20 30 40 50 60 70 80 90 100
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR MARCH, 1920.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—clear, P C—partly cloudly, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

Society Officers in a "Swing Around the Circle."

In the course of their "swing around the circle" officers of the heating engineers' society, including Director John R. Allen of the society's Research Bureau, Chairman F. R. Still of the Research Bureau Committee, and Secretary C. W. Obert, were guests of honor at the meeting of the Minnesota Chapter in Minneapolis, March 19; at the meeting of the St. Louis Chapter, March 13, and at the meeting of the Ohio Chapter, in Cleveland, April 8.

Kansas City Chapter Discusses Ozone.

Supplementing his paper on ozone in public schools, presented by E. S. Hallett, chief engineer of the St. Louis Board of Education at the recent annual meeting of the heating engineers' society, Mr. Hallett addressed the Kansas City Chapter at its April meeting, giving further data on the successful results obtained with ozone.

It was announced at the meeting that J. H. Brady, chief engineer of the Kansas City Board of Education, is preparing to install an ozone system in Kansas City. It is believed, among other things that it will cut the fuel bills materially. Mr. Brady has been investigating the results obtained in St. Louis. A recent ozone installation has also been made in St. Joseph, Mo., by H. C. Westover, engineer for the St. Joseph Board of Education.

New York Chapter Elects Officers and Discusses Hot Water Supply for Buildings.

A full program that ranged from suggestions for remedying present-day industrial conditions and reasons for anticipating an early drop in commodity prices, to a varied discussion of hot water supply for buildings, brought out a large attendance at the April meeting of the New York Chapter, April 19. The meeting was held as usual in the rooms of the Building Trades Club. It was also the meeting for the election of officers.

President Perry West, who presided, reviewed the previous year's work, stating that the chapter had found its best slogan to be entertainment in service, rather than service in entertainment. Unbounded opportunities for service, he said, had been developed during the year. One of these is in connection with the betterment of industrial relations and he called upon Frank T. Chapman, chairman of a special committee on this subject, to present his report. The report embraced the many points brought out at previous chapter meetings and recommended the adoption by the heating engineers' society of the principles drawn up by the American Society of Mechanical Engineers (published in THE HEATING AND VENTILATING MAGAZINE for February, 1920).

The report was accepted and it was also voted to urge its adoption by the society at its midsummer meeting in St. Louis. The report provides for a permanent committee of five to study economic problems and to carry on a campaign to get engineers to assist in improving the present industrial situation.

The tellers then announced the election of the following officers for 1920-1921: President, W. L. Fleisher; vice-president, A. S. Armagnac; treasurer, W. J. Olvany; secretary, F. C. Heiles. Members of the Board of Governors: Perry West, Conway Kiewitz and B. K. Strader. They will be installed at the chapter's May meeting.

The first scheduled speaker of the evening was Ralph B. Wilson, secretary to President Babson, of the Babson Statistical Service. Mr. Wilson, spoke interestingly of the methods used by the Babson service to analyze business and industrial conditions generally. Incidentally he stated that according to the theory of action and reaction of business which, statistics show, follow each other in regular sequence, we are almost due for a general drop in commodity prices and for a slackening up of business.

Before the technical session was begun, R. A. Wolff, chairman of the chapter's committee on Research Bureau Fund, told of the campaign to raise additional funds for the Research Bureau, extending from May 1 to May 15.

The technical program was then taken up, the first speaker being A. B. Christen, Sales engineer for the Anti-Corrosion Engineering Company.

Among the many valuable points brought out were that the temperature limits of domestic hot water supply should be between 170° and 180° F. The water, it was stated, should be so hot as to require the admixture of cold water. A number of curves were presented showing the hot water consumption in a number of buildings of various types, showing the effect of location, character of occupants and other conditions. Those in better locations, for instance, and occupied by a better class of tenants, had its peak load between 9 and 10 o'clock in the morning, while those in less favored districts or at a considerable distance from the business centers showed an earlier peak load. The average hot water consumption in high-grade apartments will average 30 gal. per min., and in low-grade apartment buildings, 11 gal. per min. The load in office buildings will run very evenly during the day, the maximum coming after office hours during the cleaning up period, although one speaker mentioned the noon hour as the time of the peak. In large hotels it is usual to figure an average load of 240 gal. per min.

W. E. Evans, sales engineer for the Whitlock Coil Pipe Co., outlined the various types of equipment used to heat water, differentiating between service and industrial uses. A copper coil, he said, is essential in heating salt water. It is better, he said, to use low-pressure, rather than high-pressure, steam to heat water as the water will heat to within 20° of the temperature of the heating medium and with low-pressure steam, the desired water temperature will be obtained without special regulation.

For swimming pools, instantaneous water heaters were recommended as the most advantageous as the fluctuations are smaller than in other classes of work.

When heating water with steam, the steam-regulating valve should be one-half the area of the steam pipe, as a heater can easily fall down if the steam pipe should be so small as to reduce the steam velocity below the desired rate of 5000 ft. per minute.

Figures were given for both the Pennsylvania and Commodore Hotels. Owing to the lateness of the hour, it was necessary to forego the discussion of the many points brought out and it is probable that another meeting will be devoted to the subject.

Talk on Vacuum Pumps at Meeting of Illinois Chapter.

Electrically-driven vacuum pumps were the principal topic for discussion at the April meeting of the Illinois Chapter, held April 12 at the Chicago Engineers' Club. Sixty-five members and guests were present.

The meeting was addressed by J. J. Hayes of the Stannard Power Equipment Co., Chicago, local agent of the Jennings-Nash hydro turbine vacuum and boiler-feed pump; by E. B. Carr of the Thompson Manufacturing Co., Des Moines, Ia., manufacturers of an interesting type of electrically-driven rotary vacuum and boiler-feed pump and by F. P. Perkins, representing Howard A. Young of Chicago, manufacturer of the Young centrifugal combined vacuum and boiler-feed pump, in which an electrically-driven centrifugal pump is ingeniously combined with a receiving tank and ejector to produce the desired results.

Mr. Hayes gave some interesting data on the selection of pumps for given duties. Mr. Carr described the way in which the air and water are handled by the same rotor of the Thompson pump. As an instance of the economy effected by this design, a case was cited of 5000 sq. ft. of radiation being handled by a pump of one-half horse-power.

The points brought out by the speakers led to an interesting discussion. The meeting was in charge of a committee consisting of H. G. Thomas, chairman; I. N. Soper and C. W. Johnson. Models of the various types of pumps described were exhibited at the meeting.

MAKING GAS HOUSE-HEATING COMMERCIALLY POSSIBLE

Steps Taken in Various Centers to Enable Gas to Compete Successfully with Coal

One of the signs of the times is the determined effort on the part of the gas industry to capture at least its share of the house-heating field. This movement is being promoted primarily by the gas companies themselves in an effort to increase their business and, incidentally, to secure a better load factor. The manufacturers of gas heating boilers are also, of course, heartily behind the movement and are already pointing with pride to the impressive number of recent installations in localities where this form of heating is more or less of a novelty.

In St. Louis the campaign is being worked up on the basis of lower rates for block heating. For instance, the Laclede Gas Light Company, of that city, has published a schedule of rates which is particularly calculated to encourage "block heating." According to this schedule, a base rate of 95 cents gross and 85 cents net per 1000 cu. ft. of gas is made for the minimum amount used in any one month through one meter. For greater amounts the rates are reduced to 70 cents gross and 60 cents net; and for even larger amounts, to 60 cents gross and 50 cents net.

During the past ten years in which the company has pushed its efforts in the house-heating field, practically every type of building in St. Louis has been equipped for gas heating, requiring the maintenance of a well-balanced and thoroughly-organized department to take care of this particular branch. In a recent review of the company's progress in this field, reported in *Gas Age*, it is stated that St. Louis house-heating installations have proved so satisfactory that no special gas rate inducement is necessary to obtain and hold the business, the regulation schedule of rates, as given herewith, being adhered to for this class of business, the same as any other usage. An active campaign is under consideration, however, for securing house-heating business in St. Louis during the season of 1920-1921.

The Gallaher boiler is made in units of 4 H. P. and upward. The cast iron boiler sections consist of four triangular water tubes. These sections are assembled with cast-iron push nipples. They are interchangeable and terminate front and back in a water-circulating chamber. The base construction leaves 8 in. clearance between gas burners and floor, so as to permit free air circulation and further providing for floor sweeping under boiler, if desired. The fire travel is so directed as to impinge on the base of each tube and in its upward movement envelops all sides of the triangular water tubes. This, it is found, adds materially to its efficiency.

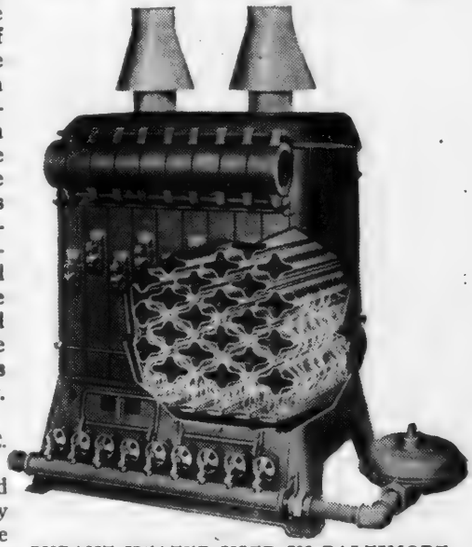
SECONDARY RATES IN EFFECT IN BALTIMORE.

In Baltimore, in 1916, the Consolidated Gas, Electric Light & Power Company put into effect a new system of rate schedules, providing for a secondary rate of 35 cents per 1000 cu. ft. for all gas sold in excess of a certain amount per month. This amount was known as the customer's "primary rating" and was determined, in the case of a domestic customer, by the number of rooms in his premises, and, for a commercial customer, by his maximum hourly consumption. Later a provision was made for basing the primary rating of customers' heating of large commercial buildings upon the square feet of floor area in the building.

This very low rate for excess gas consumption, it is stated, made it possible to undertake the heating of buildings on a large scale and in competition with coal-fired furnaces and boilers.

The secondary rate for gas was raised to 50 cents per 1000 cu. ft. in December, 1918, but the present prices of hard coal, it is claimed, make the relative cost of gas heating, if anything, more favorable to gas than it was in 1916.

The experience of the Baltimore company is that when gas is burned in an efficient gas-designed boiler, 32,000 cu. ft. of 550 B. T. U. gas is the equivalent of one long ton of hard coal burned in a standard coal furnace. Since the equivalent on a straight B. T. U. basis would be about 48,000 cu. ft., the greater



BYRANT HEATER USED IN BALTIMORE BY THE CONSOLIDATED GAS, ELECTRIC LIGHT AND POWER COMPANY.

efficiency of application of gas-fired systems, it is claimed, is demonstrated.

From the figures given it can be seen that gas at 50 cents per 1000 cu. ft. is equivalent to paying $16.00 per ton for coal, only bare fuel costs being considered.

Regarding the installations themselves, after some practice and some mistakes it was found possible to design and build burners to meet the requirements of any coal furnace that it was desired to convert, and it was learned how to build burners that would give no flashback trouble when operated by the thermostat, and that would have greater proportionate burning capacity and better operating characteristics than burn-

ers that could be bought ready made. A number of the improvements in design worked out by the Baltimore company have been adopted by the maker of the boiler. The company buys its warm-air furnaces without burner equipment and makes its own burners.

The boiler that is being used by the Consolidated Gas, Electric Light and Power Company of Baltimore is that made by the Bryant Heater & Mfg. Company and the thermostat, that of the Minneapolis Heat Regulator Company.

In speaking of the burners used, Thomson King, superintendent of fuel sales for the company, states that the company designs a number of burners for converting coal furnaces to the use of gas. For this work the company developed its own rules and constants and were able to produce very good burners, but they were designed for each individual case and made up from wrought-iron pipe.

It is estimated that there are now operated in Baltimore about 4200 burners in heating boilers and furnaces. Since practically all of these are under thermostatic control, it is probable that each of these burners is turned on and off an average of twelve times per day. This makes a total of 50,400 burners turned on per day. The company has never used any gauze in any of its burners and the absence of flash-back troubles is given as evidence of the good design of the burner.

THE LACLEDE GAS LIGHT COMPANY

EFFECTIVE JULY 1, 1919

SCHEDULE OF RATES TO BE CHARGED FOR GAS USED THROUGH ANY ONE METER IN ANY ONE MONTH, AS FOLLOWS:

MINIMUM BILL, 50c A MONTH

FOR 0 TO 200 CUBIC FEET CAPACITY PER HOUR REQUIRED BY CUSTOMER

FIRST 7,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH ONE METER, 95C PER THOUSAND CUBIC FEET GROSS; 85C PER THOUSAND CUBIC FEET NET.

NEXT 6,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 70C PER THOUSAND CUBIC FEET GROSS; 60C PER THOUSAND CUBIC FEET NET.

ALL IN EXCESS OF 14,600 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER 60C PER THOUSAND CUBIC FEET GROSS; 50C PER THOUSAND CUBIC FEET NET.

FOR 201 TO 800 CUBIC FEET CAPACITY PER HOUR REQUIRED BY CUSTOMER

FIRST 11,100 CUBIC FEET USED IN ANY ONE MONTH THROUGH ONE METER, 95C PER THOUSAND CUBIC FEET GROSS; 85C PER THOUSAND CUBIC FEET NET.

NEXT 6,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 70C PER THOUSAND CUBIC FEET GROSS; 60C PER THOUSAND CUBIC FEET NET.

ALL IN EXCESS OF 17,900 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 60C PER THOUSAND CUBIC FEET GROSS; 50C PER THOUSAND CUBIC FEET NET.

FOR 801 TO 2,000 CUBIC FEET CAPACITY PER HOUR REQUIRED BY CUSTOMER

FIRST 30,300 CUBIC FEET USED IN ANY ONE MONTH THROUGH ONE METER, 95C PER THOUSAND CUBIC FEET GROSS; 85C PER THOUSAND CUBIC FEET NET.

NEXT 6,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 70C PER THOUSAND CUBIC FEET GROSS; 60C PER THOUSAND CUBIC FEET NET.

ALL IN EXCESS OF 37,100 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 60C PER THOUSAND CUBIC FEET GROSS; 50C PER THOUSAND CUBIC FEET NET.

FOR 2,001 TO 3,000 CUBIC FEET CAPACITY PER HOUR REQUIRED BY CUSTOMER

FIRST 37,400 CUBIC FEET USED IN ANY ONE MONTH THROUGH ONE METER, 95C PER THOUSAND CUBIC FEET GROSS; 85C PER THOUSAND CUBIC FEET NET.

NEXT 6,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 70C PER THOUSAND CUBIC FEET GROSS; 60C PER THOUSAND CUBIC FEET NET.

ALL IN EXCESS OF 44,200 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 60C PER THOUSAND CUBIC FEET GROSS; 50C PER THOUSAND CUBIC FEET NET.

OVER 3,000 CUBIC FEET CAPACITY PER HOUR REQUIRED BY CUSTOMER

FIRST 37,400 CUBIC FEET USED IN ANY ONE MONTH THROUGH ONE METER, PLUS 1,000 CUBIC FEET FOR EACH ADDITIONAL 100 CUBIC FEET (OR FRACTION THEREOF) OF HOURLY CAPACITY REQUIRED, 95C PER THOUSAND CUBIC FEET GROSS; 85C PER THOUSAND CUBIC FEET NET.

NEXT 6,800 CUBIC FEET USED IN ANY ONE MONTH THROUGH THE SAME METER, 70C PER THOUSAND CUBIC FEET GROSS; 60C PER THOUSAND CUBIC FEET NET.

ALL IN EXCESS OF THE SUM OF SUCH VOLUMES USED IN ANY ONE MONTH THROUGH THE SAME METER, 60C PER THOUSAND CUBIC FEET GROSS; 50C PER THOUSAND CUBIC FEET NET.

THE DISCOUNT OF 100 PER THOUSAND CUBIC FEET IS ALLOWED ON GROSS AMOUNTS OF MONTHLY BILLS RENDERED UNDER THIS SCHEDULE IF SUCH BILLS EXCEED THE MINIMUM CHARGE AND BE PAID WITHIN THE PUBLISHED DISCOUNT PERIODS.

"BLOCK HEATING," RATES ADOPTED IN ST. LOUIS BY THE LACLEDE GAS LIGHT COMPANY.

CORROSION OF FLUE PIPES.

Various methods have been tried to prevent the corrosion of flue pipes on water boilers. The boilers used cool the products of combustion to within 20° of the temperature of the water in the boiler. This means that in many cases, the boiler is discharging its burned gases into the flue lining at a temperature of 150°. Where a large amount of gas is burned, this caused a considerable amount of condensation and it was found that galvanized or black iron flues would sometimes be destroyed in three or four months.

One remedy tried was to use black iron piping which had been dipped in an acid-resisting paint. This, however, did not give enough protection. The Baltimore company has since used flues made of terne plate. While this lasts longer than dipped pipe, it is not entirely satisfactory. Flues made of terra cotta and sheet lead, it is stated, have been found the only satisfactory alternative the temperature of the flue gases is raised. This. however, would have to be at the expense of the efficiency of the boiler.

IMPORTANCE OF THERMOSTAT.

Experience, it is stated, has shown that one of the most important parts of a gas heating system is the thermostat and the Baltimore company insists on the installation of a thermostat with every boiler or furnace.

In Baltimore cordial relations have been established with many of the more important heating contractors who are making gas heating work an important part of their business.

An important element in the gas house heating work is the maintenance of an inspection service. At least four inspections of heating systems each heating season are recommended. The Baltimore company makes it a practice to answer promptly all trouble calls and complaints. The inspection department takes care that burners are cleaned, adjustments made, advice and instruction given, orders taken for repairs, and renewals made of thermostat batteries.

Progress in the Gas Industry.

An idea of the enlarged scope of the gas industry is given in a booklet published by the American Gas Association. This association was formed in June, 1918, because the collective judgment of a maojrity of gas interests agreed that the industry needed a well-organized and powerful central organization as its official spokesman. It is a general clearing house of gas information, with a permanent headquarters staff at 130 East 15th Street, New York, and numerous committees on the various technical and commercial problems connected with this field.

Among other things undertaken by the association is a canvass to locate data and conditions which have a bearing on the characteristics of the heating load. A committee is being organized to collect and digest this information. The ratings of gas-fired heating boilers, gas-fired steam radiators and the relations between gas companies and steam fitters are other subjects which will be considered by the committee. As the large storage hot water supply systems are usually taken care of by the same men who look after the househeating systems, it is suggested that the house heating committee be authorized to report on this class of work.

There is also a technical section which has jurisdiction over all matters relating to the production and distribution of gas and by-products.

At the present time there are 325 gas company members enrolled, representing approximately 75% of the total gas business of the country. In addition to the gas company members, 173 manufacturers of gas appliances, apparatus and supplies are on the membership rolls. The active membership consists of 1775 individuals employed in the business who are enrolled in the five sections into which the organization is divided. George B. Cortelyou is the president of the association. L. R. Dutton, of Jenkintown, Pa., is chairman of the technical section.

Annual Meeting of British Heating Engineers.

A feature of the meeting of the Institution (British) of Heating and Ventilating Engineers, in London, February 10, was a proposal made by the newly-elected president, W. W. Nobbs, that an addition be made to the by-laws to admit "operative members" of the craft to graduate membership in the institution. In support of his proposal he stated that it would give workmen who might desire it the opportunity to improve their technical knowledge and it might help towards a better understanding between employer and employee.

The suggestion of Mr. Nobbs was later submitted in concrete form by W. N. Haden and was to the effect that "'operative members of the trade of heating and ventilating engineering, without limit as to age, be eligible for membership in the graduate class." The resolution was adopted with the added proviso, "subject to their passing the prescribed examination," the syllabus of which was cited by the president, together with the books recommended for study by those intending to take the examination.

A carefully-prepared paper on "The Relation of Physiology to Ventilation" was presented by A. H. Barker in which he discussed at length the contrasting effects of dry and moist air, showing how important it is to consider the wet-bulb temperature in determining proper air conditions.

Heating Research Work in England.

In order to arouse wider interest and obtain greater support for its work, the Research Committee of the (British) Institution of Heating and Ventilating Engineers has recently issued an appeal, detailing the results of its investigations conducted to date and outlining those now in progress or planned for the future.

The work, which is carried on at the University College, in London, was commenced in 1911 when steps were taken to found a department of university standing for educational and research purposes. Eventually the London City Council made a grant of £300 per annum for the foundation of the department. This was accepted by the college authorities and two or three rooms in that institution were reserved for the use of the new department and the use of the engineering lecture rooms was granted.

The research work was handicapped by lack of assistance and eventually a proposal was made to the Institution of Heating and Ventilating Engineers that funds be raised for the foundation of two research studentships. Several students were appointed in succession, but it was not possible to publish any results otherwise than as papers and lectures, of which several were read before the heating engineers' institution.

Later, when the Department of Scientific and Industrial Research had been established at the college, a committee of the Institution was instrumental in helping to provide funds for conducting various researches on behalf of the Committee on Fuel Economy of the British Association. Five specific subjects were named by the College department for investigation. A committee of the institution was appointed to co-operate in this work and several bulletins were prepared for publication. It was only possible, however, to publish one of these, on account of the high cost of printing. The remaining bulletins have not, therefore, been published.

During 1917 certain researches in heat transmission through walls was carried out by a joint committee of the institution and the Building Materials Research Committee of the National Housing Committee. When this series of tests was completed the Building Materials Sub-Committee handed the whole responsibility back to the original insitution committee, whose funds were by this time very seriously depleted.

RESEARCH WORK NOW UNDER WAY.

The following researches are now being carried out:

1. Heat transmission through heavy building materials.
2. Heat emission from radiators of all types.
3. The flow of air up a hot flue.
4. The pneumatic resistance of trunks and fittings.
5. The flow of water in pipes.

All the above form part of the terms of reference of the Department of Scientific and Industrial Research to the Institution committee.

6. Fuel economy of kitchen ranges, gas, and electric cookers, etc., for the Building Materials Committee.

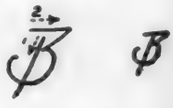
The following are College Department Researches:

7. The physical effect of different methods of heating a building, such as water, gas and electric heating.
8. The resistance of heating batteries in fan blast heating.
9. The efficiency of water boilers.
10. The efficiency of fans.
11. The flow of low-pressure steam through safety valves and other fittings and pipes.
12. The design and construction of special instruments for the above and other purposes.

Three important manuscripts and reports are ready for the press, and are only awaiting funds for their publication.

Proposed Symbol for B. T. U.

A correspondent of *Mechanical Engineering*, R. L. Weber of Kansas City, Mo., suggests the following as a symbol for the letters B. T. U. He states that the three letters here combined, may speedily be made in two strokes without the use of periods.



Current Heating and Ventilating Literature

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

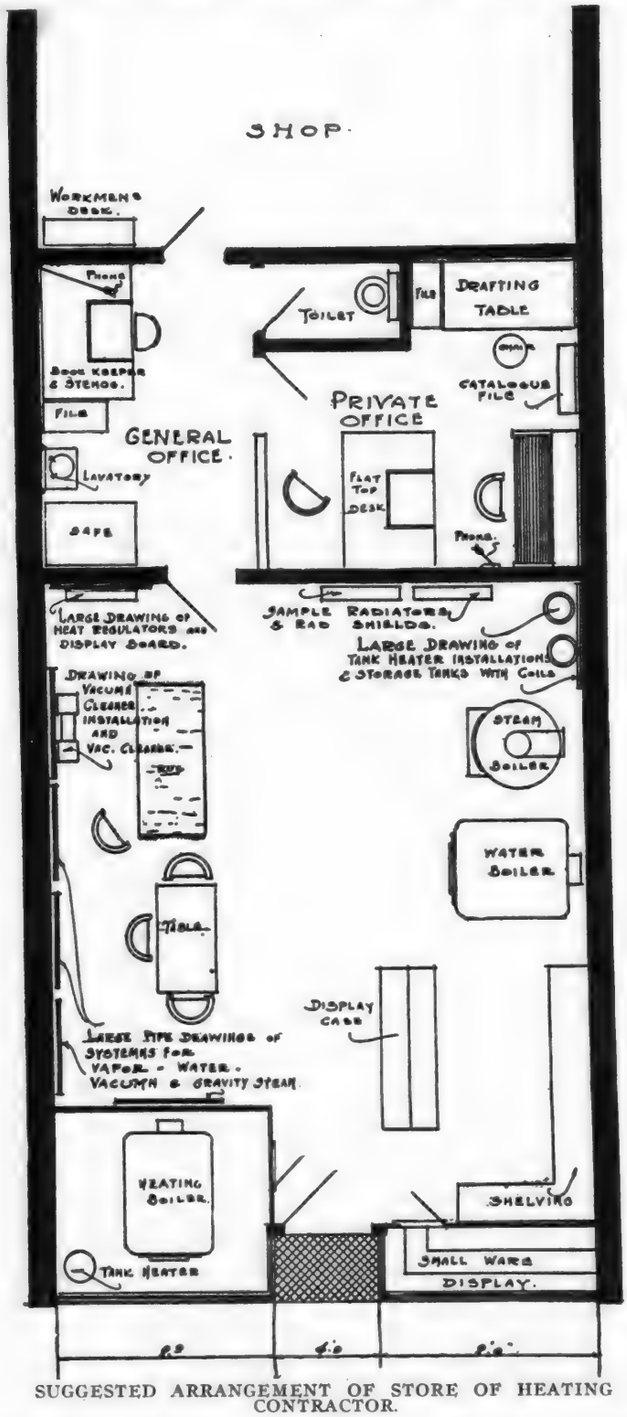
DISTRICT HEATING SERVICE

Central-Station Operation and District Heating Service, I. L. Kentish-Rankin. Elec. Rev. (Chicago), vol. 76, no. 1, Jan. 3, 1920, pp. 19-21. Writer maintains that on basis of heat production, the isolated plant existing for express purpose of producing heat and producing kilowatt-hours as by-product is more economical than central-station plant. He claims that heat passing to waste in central stations could replace many isolated plants and supply towns and settlements with heat.

NATIONAL TRADE EXTENSION BUREAU

The Store of the Heating Contractor.

A feature of the Monthly Service Bulletin of the National Trade Extension Bureau for March, 1920, shows a typical arrangement of a store of a heating contractor which is full of suggestions.



SUGGESTED ARRANGEMENT OF STORE OF HEATING CONTRACTOR.

It is recommended, for instance, that the store and shop be heated by direct radiation, pipe coils, wall radiation of different kinds and heights. The office may be heated by direct-indirect and indirect radiation. This will give a working example of all kinds of heating methods for display purposes.

A large window is provided for displaying large ware and a small window for specialties. The furniture includes a display case and shelving to contain samples of valves and other appliances and specialties that the public might call for or want to see. These might embrace thermometers, altitude gauges, air valves, floor plates, boiler compounds, repairs for tank heaters and numerous other small items that people now buy anywhere they can get them.

A roomy reception space is provided, with chairs and tables, near the front of the store. On the walls could be hung large drawings of various kinds of heating layouts. This is suggested as one of the best methods of selling a job.

Conveniently located is a vacuum cleaner and a rug for demonstrating. Over the vacuum cleaner could be placed a large chart showing the piping layout. Nearby is a heat regulator display, then a radiator display, showing all heights and columns.

Other suggested displays include a heater and tank for furnishing domestic hot water and a round and square boiler.

New Publications.

Technical Writing, by T. A. Rickard, editor of the Mining and Scientific Press, is the title of a recent book which will undoubtedly find a wide field of usefulness. The book will be especially valuable to engineers who must render written reports of the work they have done and of contemplated projects or reports of investigations, to say nothing of the general correspondence all must take care of. For engineering students it is especially valuable. Size 5 x 7¼ in. Pp. 183. Price $1.50. Published by John Wiley & Sons, New York, and may be obtained through the book department of THE HEATING AND VENTILATING MAGAZINE.

Trade and Allied Associations and Publications in New York City, Classified, have been arranged in a booklet issued by the Chamber of Commerce of the State of New York. It is published principally on account of the many inquiries for the names and addresses of trade associations in New York. Accordingly this pamphlet has been prepared to serve as a guide for those seeking trade information and business connections in New York City. Among the different line listed are architects and artists boilers, building supplies, coal, contractors, engineering, exporting, foreign trade and relations, gas hardware iron and steel, libraries, machinery, metals, oil, pipe, plumbing, refrigeration, and research organizations. Size 6 x 9 in. Pp. 24.

EMISSIVITY OF HEAT FROM VARIOUS SURFACES, by V. S. Day, is the title of the second bulletin of the University of Illinois Engineering Experiment Station in the series it is publishing on warm-air furnace research. It is published as bulletin No. 117. It deals especially with the results of com-

parative tests on covered and uncovered sheet metal surfaces, some of which have already been given in these columns. In a program received from the university of the report of progress in warm-air furnace research from May 1, 1919 to April 1, 1920, this bulletin is given first place, followed by other reports as follows:

Humidity Data for Furnace Heating with Various Types of Water Pans, by A. P. Kratz.

An Exact Method of Measuring the Amount of Air Flowing in the Leader and Stacks of a Warm-Air Furnace System, by A. P. Kratz. z

The Pipeless Furnace Testing Plant and Results of Efficiency and Capacity Tests on a Pipeless Furnace, by A. C. Willard and V. S. Day.

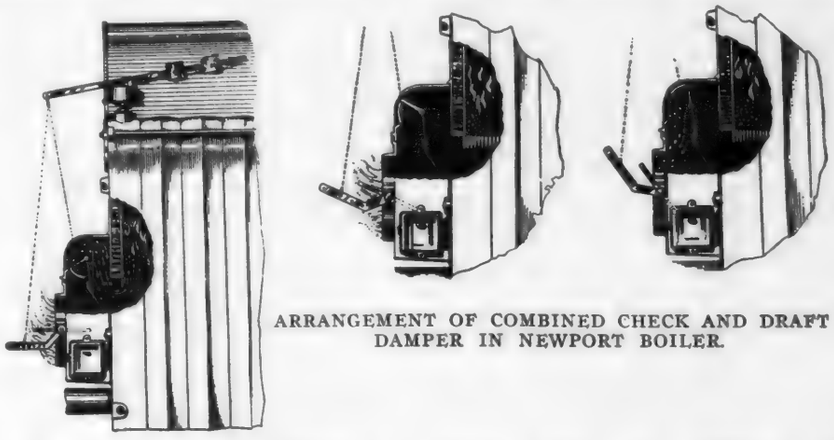
A Study of Radiation Losses from a Warm-Air Furnace, by A. C. Willard and A. P. Kratz.

Financial Statement as of April 1, 1920.

Trade Literature.

THERE IS A RADIATOR IN THIS ROOM. CAN YOU FIND IT? is the title of a pamphlet calculated to arouse one's curiosity, issued by the Fulton Co., Knoxvlle, Tenn. The answer follows immediately in the statement that the radiator is in front of the window shown, but concealed from view by an instrument that automatically regulates the temperature of the room. On turning the page the reader sees an illustration of the Ja-Nar radiator enclosure. The Sylphon temperature control, by which the Ja-Nar' is operated, permits the enclosure to be set for any temperature desired within a considerable range. In addition to providing heat control, the Ja-Nar' is described as a beautiful piece of furniture which, in addition to concealing the radiator, serves to protect the walls from soot and dust. It is made in several finishes, such as mahogany, light or dark oak, white or variously-tinted enamel. It consists of an insulated cover with all the mechanism inside. There are no connections of any kind to be made, no wires and no pipes. It is installed by simply placing it over the radiator.

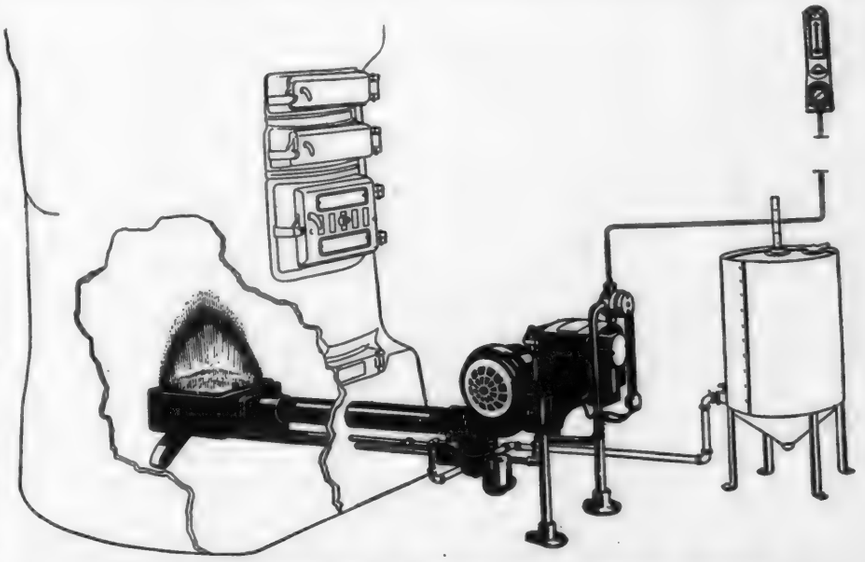
NEWPORT AUTOMATIC-FEED BOILER, detailing the many interesting features of this heater which is of the magazine-feed type, is brought to the attention of the trade in a well-compiled catalogue of handsome appearance. The catalogue presents a complete analysis of the Newport boiler, many of the features being illustrated by detail views. In the design of the heater by Charles F. Newport, it is stated that four vital points were considered necessary, including steady delivery of heat for long periods, economy in fuel consumption, infrequent attention, and adaptability to different sizes and kinds of fuel. As is well-known, the boiler is of the magazine type, one complete filling of the magazine being sufficient for two days in cold weather. One of the boiler's most unique features is its water-cooled, adjustable throat through which the fuel feeds down by gravity which not only makes it suitable for burning any given kind and size of coal but also makes it possible to change to a different fuel by a slight adjustment of the throat. Other points, such as automatic draft control, 100% over-size ash-pit, means for spraying the ashes to prevent dust and self-cleaning fire surfaces, are prominently mentioned. The analysis of the boiler is divided into 25 sections, showing how carefully every item of construction has been worked out to secure the greatest advantage and economy. Each heater is provided with an automatic regulator as part of the regular equipment, automatically controlling the patented Newport combined check and draft damper so as to maintain steadily any desired temperature. Another feature provides for shutting off one-half of the heater in mild weather by allowing the fire on one side to die out and letting the ashes remain. Two pages of typical buildings equipped with Newport boilers are presented. The catalogue concludes with ratings and measurements of both single and double-grate type, for steam and water. An addendum gives some useful points on good chimney construction. Size 8½ x 11 in. Pp. 28.



ARRANGEMENT OF COMBINED CHECK AND DRAFT DAMPER IN NEWPORT BOILER.

THE CHIEF CONSIDERATION IS DURABILITY is the title of an effective circular received from John Simmons Co., New York, and devoted to the advantages of National pipe. Among the points mentioned are that National pipe is the result of 50 years of pipe-making experience, that it is uniform in chemical and physical properties, its ductility, high-tensile strength, clean-cut and strong threads, its full-size standard weight, and the fact that all sizes 4 in. and under are Spellerized to lessen any tendency to corrosion.

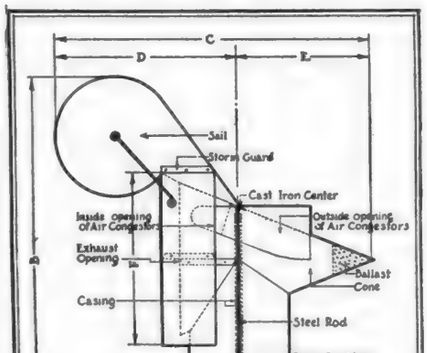
NOKOL, described as a practical automatic oil burner that can be installed in any coal furnace, and operates under the control of a thermostat entirely and leaves no dirt, is the subject of a handsome booklet issued by The Steam Corporation, a division of the Amalgamated Machinery Corporation, Chicago, Ill. It is stated that Nokol actually takes the place of coal in the furnace by applying well-known and generally-used oil-burning principles under advanced patents. These patents cover the con-



TYPICAL INSTALLATION OF NOKOL OIL BURNING SYSTEM.

struction of the appliance's combustion chamber which confines an oil flame that would ordinarily be 24 ft. high into a very limited area. This flame is produced through the coordinated operation of a pilot light, a blower, Venturi tube and float fuel chamber and burns intermittently under the control of a thermostat centrally located in the upper part of the house. It is further stated that the appliance will work at full efficiency in any furnace consuming not more than 40 tons of anthracite coal per heating season of nine months. While the appliance is especially designed to burn kerosene, the manufacturers claim that there are a number of other oils to be had more cheaply on which it will also work efficiently. The burners have been privately tested during the past two years, the present type being the result of the engineering data secured. Size 5¼ x 7¼ in. Pp. 24.

ACME AUTOMATIC ROTARY VENTILATORS, manufactured by the Acme Ventilator Corporation, Boston, Mass., are featured in a reprint from Sweet's Catalogue, bringing out the important advantages of these devices. Special care has been taken in their design to avoid corrosion, squeaks and downdrafts. At the same time no oil is used in their operation and they are described as weather-proof. The ventilator itself revolves on a case-hardened steel point against a cast-iron center. It is equipped with "air congestors," designed to cause greater suction, while the "ballas" is arranged to cause equal pressure on the sides of the rod permitting the ventilator to rotate in response to the slightest breeze. The cone is always kept pointed to the wind which passes through the large outer openings of the air congestors (one on either side of the cone) the constant pressure forcing the air through the smaller inside openings at higher velocity. The outer rim of storm guard extending beyond and being separated from the rim of the cone, serves both as protection against the weather and to increase the suction power. The circular includes full data on both galvanized-iron and copper types for capacities ranging from 5600 to 314,464 cu. ft. of air per hour. Each type is made in 12 sizes.

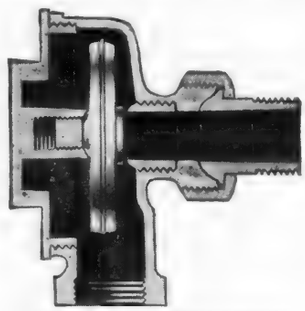


DETAIL OF ACME VENTILATOR

Size, in.	Dimensions, in.						
	A	B	C	D	E	F	G
4	4	16	13⅜	7⅜	5	7½	3½
6	6	24	20½	11⅜	8⅝	11⅜	5
8	8	32	27½	15⅜	11⅝	15	6½
10	10	40	34⅝	19⅝	14⅞	18½	8½
12	12	48	41⅝	23⅝	17½	22½	10
14	14	56	48	27⅝	20½	26½	11½
16	16	64	55	31⅝	23½	30	13
18	18	72	61⅝	35⅝	26½	33¾	15
20	20	80	68⅝	39⅝	29½	37½	17½
22	22	88	75½	43⅝	32⅝	41⅝	18¼
24	24	96	82½	47⅝	35⅝	45	20
30	30	120	103	59	44	56¼	25

CONSTRUCTION OF ACME AUTOMATIC ROTARY VENTILATOR.

IDEAL RADIATOR TRAP, manufactured by the Ideal Heating-Equipment Co., Cleveland, Ohio, and described in new circular matter, is attracting considerable attention on the part of heating engineers through the fact that it



IDEAL RADIATOR TRAP.

is designed to embrace the advantages of both the vertical and horizontal type trap. The thermostatic diaphragm is partially controlled by air cooling and also by water cooling, through the use of a large thin disc seat which is in direct contact with the water of condensation, steam or vapor. These two principles of operation combine to free the unit of radiation of air and water rapidly under all conditions, and a continuous, instead of intermittent discharge, is obtained, overcoming the objection of a small puff of steam escaping at each operation. It is pointed out that the vertical flat seat construction eliminates sediment and scale troubles as, after years of service, either part of the flat disc and semi knife blade seat may be removed and cleaned or resurfaced without special tools or equipment on a piece of ordinary fine emery cloth. A large, heavily-corrugated and concaved diaphragm is used placed in the vertical position, and closed against the steam instead of in the steam, protecting it from excessive strains and greatly adding to its life. This trap is intended for use on all low-pressure steam, vapor, or vacuum heating systems. It is especially recommended for vacuum installations, as its seat cannot be sucked or held closed by a heavy vacuum, there are no loose parts to rattle or hum, and cold water makeup is not necessary at the vacuum pump. The company guarantees to replace any part proving defective within five years.

Organization of International Chamber of Commerce.

The new International Chamber of Commerce, projected at the International Trade Conference at Atlantic City last October, will be formally organized, it is announced by the Chamber of Commerce of the United States, at Paris during the week of June 21, 1920. About 100 American delegates are expected to attend. The new body will maintain a permanent international headquarters to centralize all data concerning economic subjects and social conditions, together with the facts relating to the respective needs present production and future possibilities of each country.

George Soule, founder and president of the Soule Plumbing & Heating Co., Billings, Mont., died at his home in that city, March 23, of erysipelas. He was 61 years old. He had been in business in Billings since 1886.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at Cooperstown, N. Y., for April 1, 1920.

State of New York, County of New York, ss.

Before me, a notary public in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the Editor of THE HEATING AND VENTILATING MAGAZINE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443 Postal Laws and Regulation printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

Editor, A. S. Armagnac, 1123 Broadway, New York, N. Y.

Managing Editor: None.

Business Manager: Gustave Petersen, 1123 Broadway, New York, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or if a Corporation, give its name and the names and address of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York, N. Y.

A. S. Armagnac, 1123 Broadway, New York, N. Y.

Gustave Petersen, 1123 Broadway, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

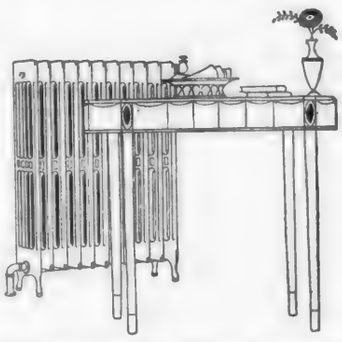
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stock holders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona-fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 17th day of March, 1920.

ALBERT C. HAGARTY.

Notary Public, Kings County, No. 131.
Certificate filed in N. Y. County, County Clerks, No. 316.
(My commission expires March 30, 1920.)



CORTO

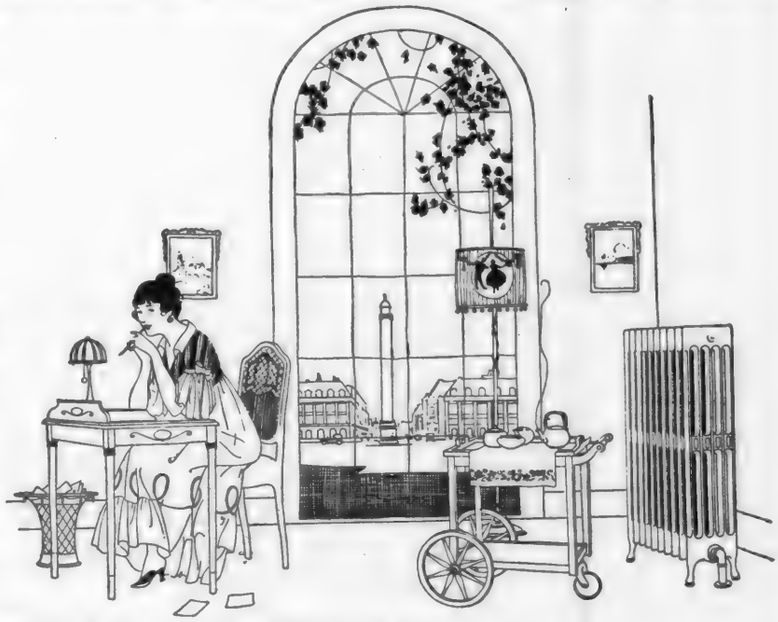
-the Radiator Classic

DESIGNED by Louis Courtot. For more than 200 years his people of the Jura, France, have created artistic forms in metal and have refined and beautified the common articles of the household.

Wherever elegance of proportion and refined lines are demanded to fit architecturally-chaste surroundings, this radiator classic, the CORTO, lends unusual distinction.

30% less space. 25% less weight

To those with whom utility is paramount, it need only be said that the CORTO, with its light, graceful tubes occupies 30% less floor space than any other type of radiator. The refinements reduce the weight one-quarter. There is far quicker circulation and venting. Utmost comfort is the result.



Our service obligation

We wish to give assurance that this new product will be attended by the same prompt and thorough service which has accompanied our goods in the past.

It will interest you to see the dainty Parisian catalog, "CORTO, the Radiator Classic." Inquiries cordially welcomed

Makers of IDEAL Boilers and AMERICAN Radiators

AMERICAN RADIATOR COMPANY

Sales Branches and Showrooms in All Large Cities

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING.

The Sterling System.

In the Sterling system, manufactured by the Sterling Engineering Co., Milwaukee, Wis., the boilers, radiators, pipe and fittings are the same as those used on other types of systems. The return pipe from the radiators, however, is connected into a general return main on which an air eliminator is installed; it is open to the atmosphere until all the radiators are full of vapor. This, of course, permits the vapor to flow into the pipes and radiators without resistance, immediately filling the entire system with vapor to the point where the thermostatic trap is installed on the bottom of the radiator. When the vapor reaches this point it comes in contact with the diaphragm in the miniature trap installed on each radiator. The operation then follows the usual course, the vapor causing the volatile liquid to expand, preventing the escape of vapor from the radiator.

The air and water are carried in the return pipe to the basement, the air from the system being discharged to the atmosphere through the automatic air eliminator, and the water or condensation being returned to the boiler. Means are taken through the use of an automatic vapor damper regulator to keep the vapor in the boiler at a uniform pressure and the graduated supply valve on each radiator (Fig. 1) places the room temperature under the control of the occupant. These supply valves are of the

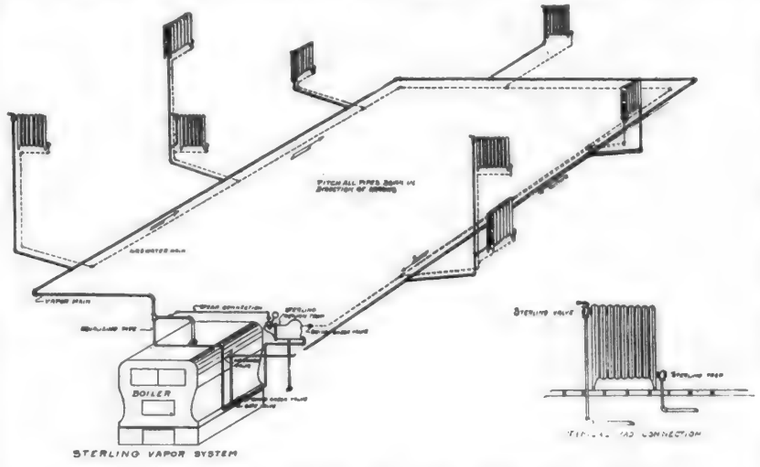


FIG. 1—TYPICAL LAYOUT OF THE STERLING SYSTEM.

packless quick-opening type. They have the desirable feature that the tension between the packless disc and the stem can be regulated by loosening or tightening the screw in the top of the handle. The valve can be easily taken apart.

In the construction of the Sterling diaphragm radiator trap it may be noted that the diaphragm cannot collapse from pressure and that it has a continuous, rather than an intermittent, discharge. It also has a vertical self-cleaning seat, while the diaphragm is concave, assuring flexibility.

A unique feature of the Sterling thermostatic trap is the adjustment device by which the position of the diaphragm in relation to the seat can be regulated without removing the trap from the radiator or disconnecting it from the return line. By means of this adjustment, the diaphragm can be set in the proper position with the steam turned on and thus an accurate adjustment made. After once set in place, the lock screw is turned down against the end of the diaphragm stem, preventing the diaphragm from getting out of adjustment. The adjustment is covered by a washer and name plate which are held in place by a threaded ring in the top of the cover, thus hiding the adjustment from the eye and preventing same from being tampered with.

Regarding the air eliminator used, this should be placed at least 30 in. above the water-line of the boiler. It is a self-contained unit and has a check to prevent outside air from being drawn into the system.

(*Continued on Data Sheet No. 132-Q.*)

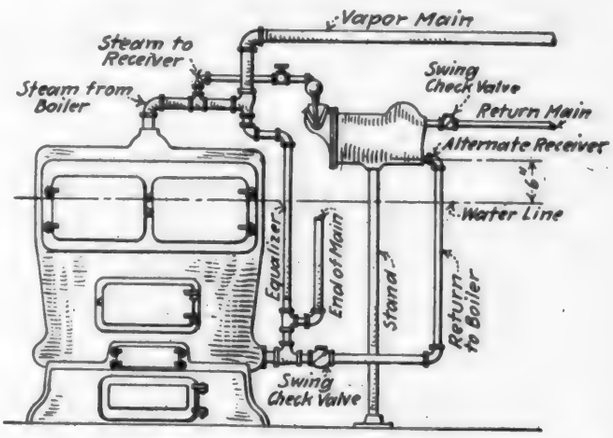
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

VAPOR HEATING.

The Sterling System.

(*Continued from Data Sheet No.* 132-P.)

The Sterling alternate receiver, used on large vapor installations or where the distance between the water level in the boiler and the level of the return line at the boiler is less than 30 in., is an ingenious device, designed to return the water to the boiler against pressure.



PROPER METHOD OF CONNECTING STERLING ALTERNATOR AND AIR SEPARATOR

The valve in the Sterling alternator and air separator never leaves its seat. It is of the slide-valve type and as the trap or receiver fills and discharges, thus raising and lowering the float, the slide valve moves forward and backward over the steam and exhaust ports, first allowing the air from the system to escape to the atmosphere, as the receiver fills, and then admitting steam from the boiler, when the receiver is full. This places the receiver under boiler pressure and causes the condensation to return to the boiler by gravity. The level of the outlet of the receiver can be within 6 in. of the water-level of the boiler.

The Sterling alternate receiver and air separator is for use especially on large installations or where it is not practical to use the air eliminator owing to lack of space to install the air eliminator 30 in. above the water-line. The alternate receiver can be placed as low as 6 in. above the boiler water-line, as there is no relation between the pressure carried on the boiler and on the return main when this receiver is used. It is capable of draining the system thoroughly, eliminating the air without loss of vapor and discharging the condensation to the boiler, regardless of the pressure carried, up to 25 lbs. It also prevents air from being drawn into the system and makes an excellent return trap.

(*Concluded on Data Sheet No.* 132-R.)

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY

One-Pipe Up-Feed System.

This system is in wide use and is generally employed by the U. S. Treasury and War Departments whenever an up-feed system is used.

In this system (Fig. 1) the supply or flow main is started close to the basement ceiling above boiler and grades down with the direction of flow, with a uniform grade of ¼ in. in 10 feet. The main is run full size to supply the total radiation and drops after serving the last radiator.

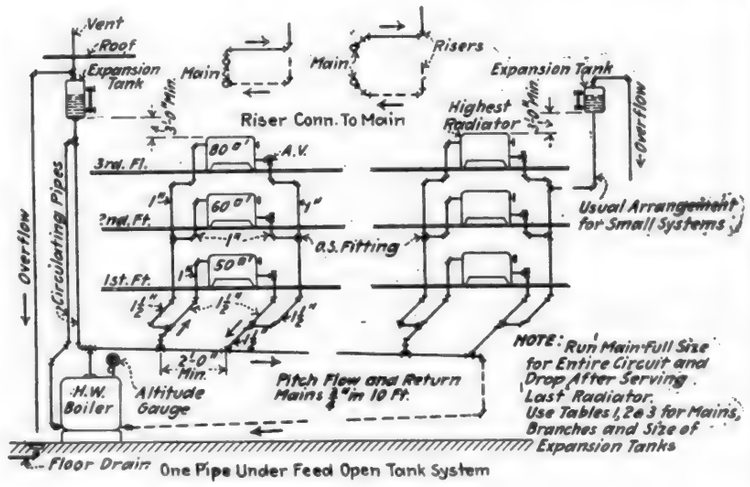


FIG. 1.

The branches are taken from the top of main or at an angle of 45° in the case of branches near the boiler, or for branches supplying only upper-floor radiators.

The return branches are connected unto the side or bottom of main. Pipe sizes are to be taken from Tables 2 and 3. (Data Sheet No. 133-B).

The branch connections for flow and return branches to any group of radiators should not be made closer than 2 ft. measured along the main. Sizes of expansion tanks are given in Tables 3, (Data Sheet No. 133-B).

WATER HEATING, GRAVITY—One-Pipe Up-Feed System. No. 133-C

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

WATER HEATING—GRAVITY.

Down-Feed Systems.

In the down-feed system (Fig. 1) the flow main, after leaving boiler, is run as a main riser to the attic or top-floor ceiling and run around same as a main. The overhead branches to drop risers are taken from the side or bottom of the main.

The main riser must be firmly supported at the base and is provided with bushed T of twice the size of the main riser at top to act as an enlarged chamber for the rapid separation of air for removal through the vent line to the expansion tank.

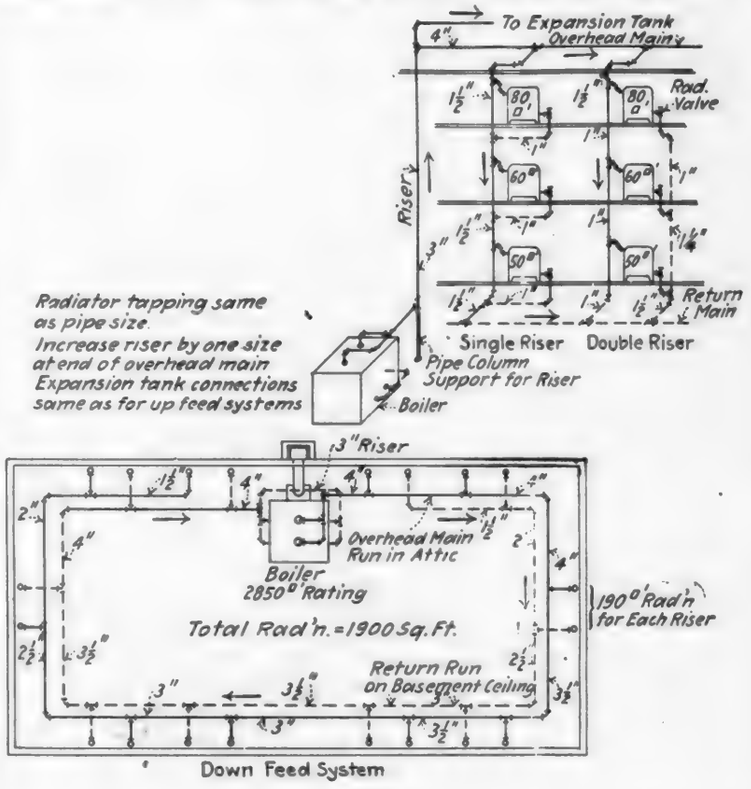


FIG. 1.

The flow main in basement uniformly grades up from the boiler to the foot of main riser and uniformly grades down from the riser in the attic. Grade ¼ in. in 10 ft.

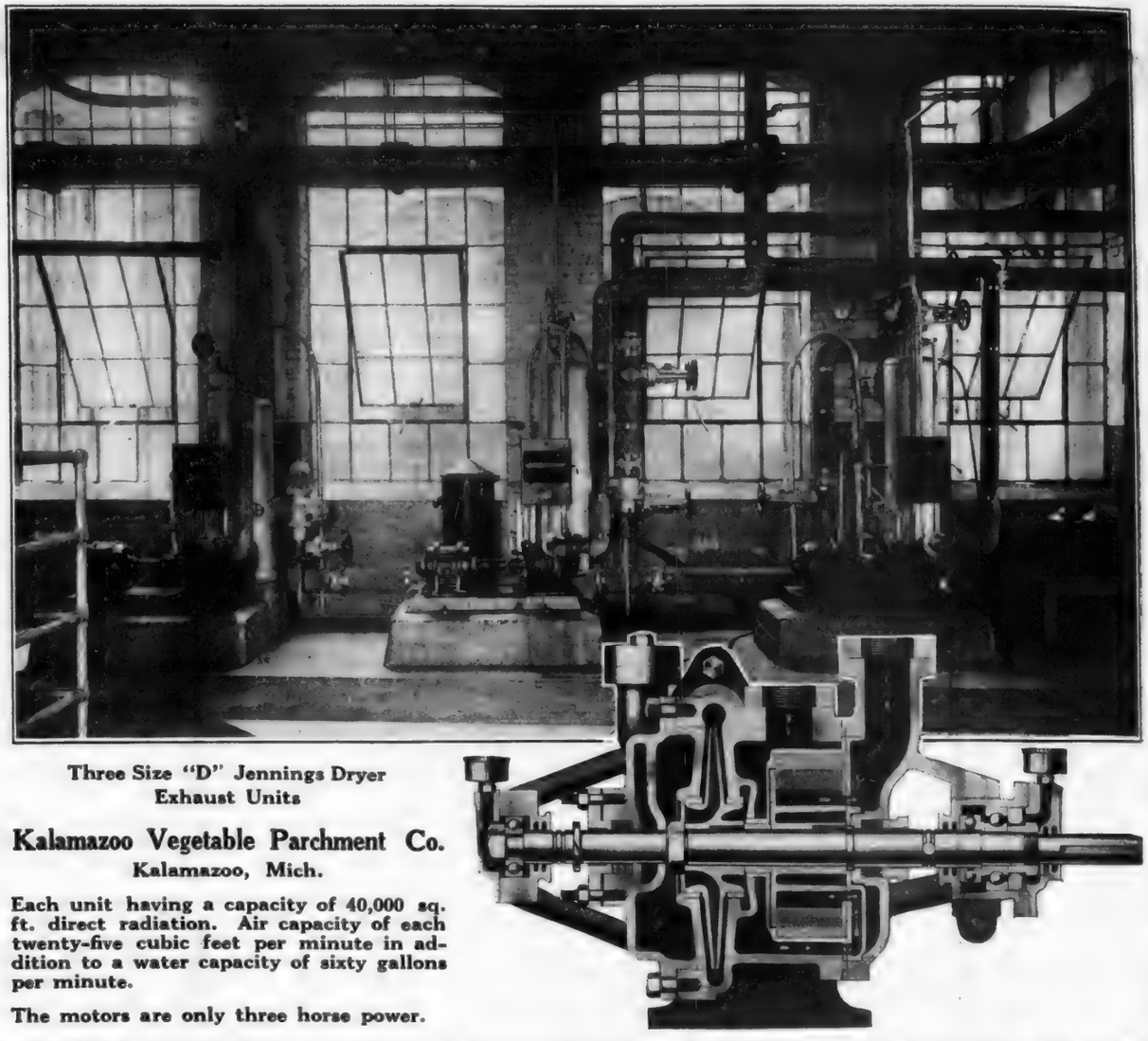
If single risers are used, sizes may be taken from Table 1. Proportion each section of the riser for the amount of radiating surface it must serve both as a supply and a return line.

If double risers are used they are made somewhat smaller than the single risers and are proportioned as flow and return risers respectively. See Table 1, Data Sheet No. 133-E.

In the overhead system the pipe sizes for the same amount of radiation on any floor is the same.

(*Concluded on Data Sheet No. 133-E.*)

EFFICIENT HEATING
demands the JENNINGS PUMP



Three Size "D" Jennings Dryer Exhaust Units

Kalamazoo Vegetable Parchment Co.
Kalamazoo, Mich.

Each unit having a capacity of 40,000 sq. ft. direct radiation. Air capacity of each twenty-five cubic feet per minute in addition to a water capacity of sixty gallons per minute.

The motors are only three horse power.

THE Jennings Pump consists of two independent turbine units, an air pump and a water pump. As each material is handled separately, the boiler pressure is against the water only. The air and vapor, approximately four-fifths of the volume handled, are delivered to atmosphere without back pressure. The saving in horse power is over fifty per cent.

Because of its compact design, this equipment can be installed in less than one-third the space necessary with other apparatus. All interior parts are bronze, supported on annular ball bearings mounted outside of casing. Moving parts revolve without contact.

There are many other reasons why the Jennings is being installed on practically all of the big jobs. Bulletin No. 8 gives then all in detail. Write for it.

NASH ENGINEERING COMPANY
SO. NORWALK, CONN., U. S. A.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

May 24-27, 1920.—Thirty-first annual convention of the Heating and Piping Contractors' National Association in Cleveland, O. Headquarters at the Hotel Cleveland.

May 25-27, 1920.—Annual convention of the National District Heating Association in Chicago, Ill., Headquarters at the La Salle Hotel.

May 24-27, 1920.—Spring meeting of the American Society of Mechanical Engineers, in St. Louis, Mo.

May 26-28, 1920.—Summer meeting of the American Society of Heating and Ventilating Engineers, in St. Louis. Headquarters at the Hotel Statler.

Miscellaneous Notes.

Milwaukee, Wis.—The sum of $2,589,500 is required to make the necessary repairs during the coming year in Milwaukee school buildings. Of this amount $715,000 is required for heating plants. The school board's annual repair fund amounts to $130,000 and it is proposed to secure the authorization of an increase in the repair fund by the State legislature.

New York.—An amendment proposed to the New York Building Code, soon to come before the Bureau of Standards and Appeals for a hearing, provides that theatres and other places of public assembly, except churches, shall be ventilated so as to provide at least 500 cu. ft. of fresh air per hour per occupant.

Portland, Me.—Plumbing, Steam and Metal Salesmen's Association of Maine, met in Portland, Me., March 8, under trying conditions, due to a series of severe snow storms that almost cut off the city. New officers were elected as follows: President, Joseph E. Herrick, Boston, New England manager of the Monitor Bi-Loop Radiator Co.; first vice-president, Everett C. Mann, Austen & Doten Co., Boston; second vice-president, Harry D. Files, Files Engineering & Specialty Co., Boston; third vice-president, A. M. Rosebrooke, Portland, Gurney Heater Mfg. Co.; treasurer, R. C. Parker, Smith & Abbott Co., Portland; financial secretary, Blain J. Harmon, C. M. & H. T. Plumber Co., Portland; recording secretary, Eugene H. Winslow, Winslow & Co., Portland.

Alf Tjersland, president of the engineering firm of E. Sunde & Co., Christiania, Norway, who has been making a tour of this country, studying American heating and plumbing methods in company with his chief engineer, S. Frivik, has been spending some time on the Pacific Coast, following a three-days' visit at the headquarters of the National Trade Extension Bureau in Evansville, Ind. Mr. Frivik sailed for Norway early in April.

March Building Operations, according to the F. W. Dodge Company's review of building activity, show a great increase over the figures for January and February, in spite of the talk that construction work was being held up on account of high prices, high wages, and shortage of material. The figures were $327,897,000, as

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against $235,848,000 for January and $216,663,000 for February. At the same time it is stated there is still a vast amount of work awaiting more favorable conditions. In New England the building contracts awarded in March amounted to $42,584,000, a figure greater than the combined totals of January and February. In New York State and northern New Jersey the March contracts awarded amounted to $66,623,000, compared with $79,570,000 in January and $36,375,000 in February. The showing in the Philadelphia, Baltimore and Washington districts was especially good, the figures being $50,036,000, compared with $26,190,000 in January and $31,854,000 in February. An equally good showing was made in the Pittsburgh district and in the Central West. In the Northwest, covering Minnesota and North and South Dakota, the March building contracts totaled $11,038,000, as compared with $7,246,000 in January and $6,017,000 in February.

Paris Marché du Monde (Paris World's Mart) has been established in Paris, France, designed to comprise sales and display rooms and offices for all industries. It is pointed that this is not an exposition, but a permanent building of large proportions, where buyers from all countries may congregate to inspect and purchase the goods they desire. The headquarters of the enterprises are at 18 Rue Taitbout, Paris, and an American office is maintained at the Hotel McAlpin, New York, under the direction of Milton L. Schmitt.

New York Building Superintendents' Association, at a recent meeting called to discuss the betterment for conditions of unskilled building-operating employees, adopted a resolution to the effect that "owing to the increased cost of living expenses over that of 1914 as a base, an increase of wages of 85% as a minimum and 100% as a maximum over the wages of 1914 would be most satisfactory and just to all concerned, working hours to remain as of today."

St. Louis, Mo., is given the credit by the National Safety Council for

THE AIR YOU BREATHE SHOULD BE AS PURE AS THE WATER YOU DRINK

AT WORK RESTAURANT AT HOME

Ventilation in offices and factories will prevent that afternoon let down. Restaurants can increase patronage by removing cooking odors and heat. At home the lady of the house will find that correct ventilation makes kitchen work a pleasure.

ILG "Self Cooled Motor" Propeller Fans are serving thousands of users satisfactorily in every line of industry. Contractors and dealers will find a growing demand for "ILG" apparatus. Send for literature and discounts.

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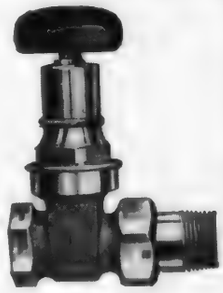
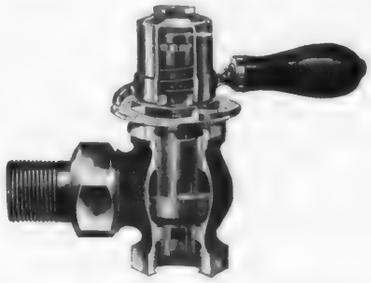
DOLE PACKLESS RADIATOR VALVES



Insure Satisfaction

A Valve for Every System



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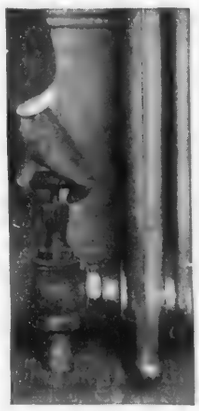
The Dole Valve Company
208 North Wells St. CHICAGO

Trouble Free—



Know Genuine Jenkins Valves by the Jenkins "Diamond Mark"

A heating system is no more satisfactory than the radiator valves.

The Jenkins Radiator Valve is not an ordinary radiator valve—it contains more metal, is of a stronger construction throughout, especially at points where the strain and pressure is greatest.

It cannot leak—the bonnet is large, with ample room for packing (it is furnished ready packed.)

The Jenkins renewable composition disc, with which all globe, angle, offset and corner valves are fitted, forms a perfect contact on the seat.

A Manganese bronze spindle with deep, even threads make the opening and closing operation easy.

The union makes the valve easy to install. For a job of lasting satisfaction use Genuine Jenkins Radiator Valves.

JENKINS BROS.

New York Chicago Philadelphia
Boston Pittsburg Washington
St. Louis San Francisco Montreal
London Havana

Jenkins Packing

JENARCO 96 96 96 96 96 96

Getting the final payment

So often it's the little things, like trap adjustments, that hold up final payments, and cause you additional expense on which you haven't figured.

But there's never any question about the adjustment of Johns-Manville Radiator Traps—because there's nothing about them to adjust.

Why they work

A hollow copper ball does the work. When there is no water to discharge, the ball is held against the discharge outlet. As water flows into the trap, the ball rolls up, exposing the outlet, and water is discharged. Any air that may be present is also drawn off. When the water level falls, the ball rolls down with it, preventing the loss of steam.

H. W. JOHNS-MANVILLE CO.
New York City
10 Factories
Branches in 63 Large Cities

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Canadian Johns-Manville Co., Ltd.
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COVERS THE CONTINENT

Through—

Asbestos

and its allied products

JOHNS-MANVILLE
Serves in Conservation

Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS MANVILLE
Radiator Trap

being the safest city in the United States. The next safest cities in order are Cleveland, Cincinnati, Pittsburgh, Kansas City, Wilmington, New York, Minneapolis, Buffalo, Portland, Ore.; and Rochester. St. Louis's claim is based on a report of Coroner R. S. Vitt of that city which shows that in 1919, with a population of 922,000, St. Louis had fewer coroner's inquests than in 1901, when its population was only 604,000, and that industrial fatalities were reduced from 110 in 1917 to 42 in 1919. The National Safety Council announces that early in May a "Safety Week" campaign will be conducted in a number of cities, including Akron, O.; Wilmington, Del., and a group of cities in the Lehigh Valley of Pennsylvania, including Bethlehem, Allentown and Easton. In a number of the leading cities the Council has already established schools for chauffeurs, schools for traffic policemen, schools for foremen and safety supervisors and round table conferences for executives.

Princeton University announces the establishment of a professional School of Architecture. It will cover the subjects required in the best schools already established, but will be organized and conducted along somewhat different lines. It will offer the degree of master of fine arts and the fact that the degree is obtained in architecture will be specially mentioned in the diploma. It will be conducted as a part of the Graduate School.

William M. Kingsbury Engineering Co., which has recently opened offices in Pittsburgh at 230 Fifth Avenue, is designing the mechanical equipment for the Roosevelt Theatre, Pittsburgh; High Schools in Pittsburgh and McKeesport and the Lincoln and Garfield Schools in New Castle.

George B. Nichols has resigned as chief engineer for the New York State Department of Architecture to take up a larger field with the engineering department of the E. I. Du Pont de Nemours & Co., Wilmington, Del. He will be retained by the State, however, as consulting engineer to the Department of Architecture. He has been succeeded by Ralph M. Taggart, formerly assistant chief engineer. Mr. Taggart's many friends in the metropolitan district will be pleased to hear of his advancement, as he was formerly in business in New York, being associated with William J. Baldwin.

Eastern Trade Golf Association, at its annual meeting in New York, April 14, elected the following officers: President, W. M. Cosgrove, American Radiator Co.; vice-president, W. W. Hubbard, W. G. Cornell Co.; secretary-treasurer, R. G. Bookhout, Plumbers' Trade Journal; Captain, J. Barton Garfield, American Radiator Co. Board of governors: A. H. Ross, Garles Geoghegan, F. W. Broatch, W. T. Gilmour and J. E. Rutzler.
Add new publicaitons

Manufacturers' Notes.

Moline Heat, Moline, Ill., has increased its capital stock from $100,000 to $200,000. Herman Nelson is the president of the company which has experienced a remarkable growth under his administration. The secretary of the company is G. A. Shallberg.

Skinner Bros. Mfg. Co., St. Louis, Mo., manufacturers of the Baetz portable air heaters, is building a new two-story factory at Vandeventer and Hunt Avenues, St. Louis, adjoining the company's present factory. The addition will provide an additional floor area of 25,000 sq. ft. It will be of mill construction on concrete footings. The first floor will be used exclusively for the storage of heaters, while the second floor will be utilized exclusively for the manufacture of blow-piping systems which are now built at the Tenth and Taylor Streets factory. The cost of the new building, exclusive of the ground, will be $250,000.

J. H. Williams & Co., Brooklyn, N. Y., and the Whitman & Barnes Mfg. Co., Akron, O., have formed a combination whereby the manufacture of the Williams line of drop forging and drop-forged tools will be manufactured at Buffalo, Pullman, Ill., and St. Catherine, Ont., as well as in Brooklyn.

Dole Valve Co., Chicago, is building a two-story plant, 100 x 123 ft. at 1923-33 Carroll Avenue, to increase its capacity for manufacture of the

A New Idea in Exhausters

Saves on Cost Saves Space
Saves on Operating Expenses

The "Wing Scruplex" Exhauster will do all of these things.
Used for exhausting Heat, Steam, Vapors, Smoke, Acid Fumes, Spray Vapors, etc., etc.

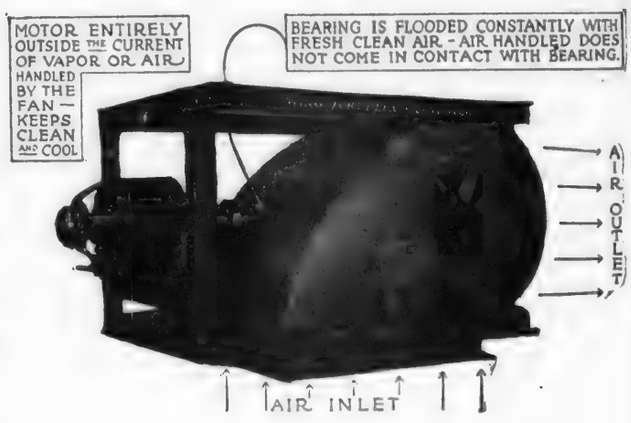
SAVES ON COST because you can buy it for less than any other equipment having the same advantages.

SAVES SPACE because it is installed as an elbow in the run of the duct or pipe and is light enough to be suspended from the ceiling, just as is the duct or pipe itself.

SAVES ON OPERATING EXPENSES because only ¼ to ½ as much power is required to drive it as compared with any other encased type of fan or blower of equal capacity costing the same.

SAVES MAINTENANCE EXPENSES because the driving motor which is a part of the unit is entirely outside of the air current where it will keep clean and can be seen and is easy of access where it will be taken care of.

The "Wing Scruplex" Exhauster is extremely flexible and may be furnished with inlet at top, bottom, either side or a combination of any of these.


MOTOR ENTIRELY OUTSIDE THE CURRENT OF VAPOR OR AIR HANDLED BY THE FAN — KEEPS CLEAN AND COOL
BEARING IS FLOODED CONSTANTLY WITH FRESH CLEAN AIR - AIR HANDLED DOES NOT COME IN CONTACT WITH BEARING.
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AIR INLET

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Steam Turbine Blowers
Damper Regulators

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TRADE MARK

Interior View of Sirocco Equipment of Buick Motor Co., Flint, Mich.

Conditioned Air in the Automotive Industry

Manufacturers of automobiles and automobile accessories are considered among the leaders in the application of heating and ventilating and air conditioning in their plants.

The installations they have made have been based upon careful study of the conditions as applied to the employe as well as the general manufacturer. They have found that in order to keep production up to the necessary standard, workers must be supplied with clear, pure air.

The view above illustrates "Sirocco" Air Conditioning equipment installed at the Buick Motor Car Company at Flint, Michigan. With this method the air is washed of all impurities and sent out into the factory heated to the proper degree for comfort in the winter and cooled to the right temperature during the summer months.

Air conditioning equipment is only a part of a number of heating and ventilating products bearing the "Sirocco" mark. If you have a problem that involves ventilating or air conditioning especially, we would like to have you get in touch with us.

AMERICAN BLOWER COMPANY, Detroit, Michigan

Branches in all large cities

Canadian Sirocco Company, Ltd.
Windsor, Ont.

Dole line of radiator valves. The building will cost $90,000.

United States Radiator Corporation, Detroit, Mich., in its report for the fiscal year ending January 31, 1920, shows gross earnings for the year of $1,113,828 and net earnings of $777,989. The surplus account shows the addition of $268,128, bringing the total surplus to $811,539. The dividends paid amounted to $196,000.

Crosby Steam Gauge & Valve Co., Boston, Mass., will build a one-story brick and steel foundry building, 48 x 104 ft., to cost $30,000.

Sterling Engineering Co., Milwaukee, Wis., manufacturers of the Sterling line of heating specialties, has increased its capital stock from $15,000 to $30,000. This company was incorporated about five years ago, starting in a small way. The rapid growth of its business has made an increase in capital stock imperative. A country-wide sale of its products has been built up through representatives in the principal cities. The officers are President, Clarence J. Rice. vice-president, Carl Maier; secretary-treasurer, George A. Anders.

Mason Regulator Co., Boston, Mass., is building a two-story addition to its plant. The new building will cost $30,000.

Kanawha Mfg. Co., Charleston, W. Va., manufacturer of the Bernhard boilers, suffered a serious loss when its plant in Charleston was destroyed by fire, March 21. The patterns, fortunately, were saved. It is likely that the company will rebuild in another city.

American Radiator Co., Chicago, Ill., has declared a quarterly dividend of 1¾% on its preferred stock payable May 15, and a $1.00 quarterly dividend on its common stock, payable June 30.

William S. Haines & Co., Philadelphia, Pa., has removed its New York office to Suite 610, Longacre Building, Broadway and 42nd Street, J. H. Davis is manager.

Richmond Radiator Co., New York, has appointed A. H. Schroth as sales manager of the company. Mr. Schroth was formerly the company's western manager. His headquarters hereafter will be in New York.

Newport Boiler Co., Chicago, Ill., has opened a New York office and showroom at 101 Park Avenue. J. F. Siegel has been appointed New York manager, covering New York and vicinity.

Uehling Instrument Co., New York, announces the appointment of Charles C. Phelps to take charge of research work for the company in connection with the efficient combustion of fuel-oil in boiler furnaces. It is estimated that nearly $100,000,000 is wasted unnecessarily every year, due to improper methods of burning fuel-oil. Mr. Phelps is a graduate of Stevens Institute of Technology and has spent several years studying power plant problems. He was connected for five years with the Ingersoll Rand Co., manufacturers of power plant equipment and pneumatic machinery. The Uehling Instrument Company has long specialized in combustion problems and are manufacturers of CO_2 recording equipment and other fuel economy apparatus.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., opened its new cafeteria April 6. It is described as the largest industrial eating place in the world. The cafeteria occupies a three-story reinforced concrete and brick buildng, 236 x 100 ft. and has a seating capacity on the first two floors alone of nearly 2600 persons. In addition, on the third floor is a dining room with a capacity of 500 and an auditorium with a seating capacity of 1000. One of the features of the building is that there are no steps in the main part of the structure. Gradual inclines or ramps are used exclusively to facilitate movement. The building and its service are typical evidence of what the larger manufacturers are doing in the way of providing for the comforts of their employees. The auditorium on the third floor is designed as a suitable meeting place for the various employee associations. It is equipped with a

Pat'd May 26, 1908

CYCLOIDAL MULTIVANE FANS

FULFILL THE ENGINEERS' OBLIGATION TO THE USERS

EFFICIENT — NOISELESS — DURABLE

Built along scientific lines—of high grade materials and best of workmanship. This coupled with our forty years experience in the manufacture of fans of all types—GUARANTEES

PERFECT SATISFACTION

SECTIONAL CATALOG NO. 120 CONTAINS CAPACITY TABLES, DIMENSIONS AND FURTHER DETAILS

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Schenley High School

Pittsburgh's most beautiful high school building is Carrier Equipped.

Every particle of air that enters this building is washed—freed from germ laden, disease breeding dust.

This pure fresh air is then warmed to the proper temperature and enters each room at just the right temperature and humidity.

In the gymnasium a cool dry atmosphere is maintained.

The room containing the swimming pool, on the other hand, requires a warm moist air, and this is made possible only with a Carrier Washer.

The class rooms and auditorium are kept at just the right temperature and the desert atmosphere common in many schools is entirely eliminated.

This ever-changing supply of clean fresh air means healthier students, better work and a cleaner building.

Let our Engineering Department assist you on your next school, office building or hospital job.

Our data is at your disposal.

Write Dept. 36 for catalog and data.

Carrier Air Conditioning Company of America

Buffalo, New York

Buffalo

stage 26 x 18 ft. complete with footlights, stage settings, etc. A motor-driven motion picture machine is installed and will be used in connection with lectures, entertainments and other gatherings. Included in the cafeteria equipment is a motor-driven washing machine, mangles, steam dryer, motor-driven ice cream freezer with a capacity of 10 gal. and an ice-making machine with a capacity of 2000 lbs. every 12 hrs. The kitchen has every possible convenience, including gas ranges, double unit combination gas and coal ranges, steam meat roaster, steam service table and other apparatus, all motor-driven. Two steam-heated kettles with a capacity of 60 gal. each are used to make soup. All the refrigerators throughout the plant are cooled by brine pipes.

Kennedy Valve Mfg. Co., Elmira, N. Y., is planning to build a one-story brass foundry.

American Radiator Co., Chicago, Ill., will build a one-story brick and steel foundry at its Buffalo plant, to cost $25,000.

H. B. Smith Co., Westfield, Mass., is building a one-story brick and concrete addition to its boiler plant in Westfield, to cost $45,000.

Garden City Fan Co., Chicago, Ill., manufacturers of fans, blowers, heating coils and kindred apparatus, has withdrawn its New York agency with the L. J. Wing Mfg. Company and will hereafter handle all Eastern business direct from the company's main office in Chicago. Owing to the present oversold condition of the trade and the unprecedented demand for its products, the company considers it a foregone conclusion that better service can be maintained by dealing direct with headquarters.

Atmospheric Conditioning Corporation, Philadelphia, Pa., announces the reopening of a Chicago office in charge of Benjamin Nelson who is the company's western manager. The Chicago office is located at 1301 Monadnock Block. Samuel G. Bloom, formerly with the Webster Air Conditioning Department, but for several years engaged in research work for Armour Company at the Union Stock Yards, in Chicago, has been elected vice-president of the Atmospheric Conditioning Corporation in an engineering and research capacity. Both Mr. Bloom and Mr. Nelson have been identified with air conditioning for a number of years and their addition to the company's already efficient organization will add materially to the firm's position on the field of engineering.

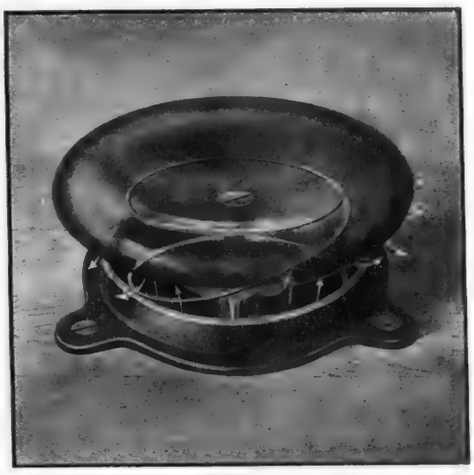
Anti-Corrosion Engineering Co., New York, which is handling the Speller process for the prevention of rust in hot water supply systems, has moved its general offices ot 117 West 54th Street.

Central Station Heating Notes.

Baltimore, Md.—In the matter of the community heating plant used for heating the Carlin community of houses and which was unable to furnish sufficient heat during the past winter, the complaining users have been assured by the public service commission that relief will be given by next winter. No intimation, however, was given as to what the changes would be, but they will no doubt include a substantial enlargement of the plant.

Tuscola, Ill.—Following the notice of the Central Illinois Public Service Company that it would discontinue furnishing heat to its patrons in Tuscola, a movement has been started by Tuscola business men to compel the company to maintain its service. For several years the company has maintained a system that supplied steam heat to a considerable portion of the business part of the town. Heat was originally furnished at rates based on the number of square feet of radiation. Later the company was authorized to install meters, which it did. This led to many complaints, due to apparent irregularities in the registration of the meters. State inspectors were called in and pronounced the particular meters in use as being unadapted to the system maintained and ordered their use discontinued. Following this action, the company went

Lehigh Mushroom Ventilators



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Efficiency in Operation

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Massachusetts Fans Move 388,372 Cubic Feet of Air

per minute in The Hotel Cleveland. For the ventilation of this hotel the engineers chose 16 single and 2 double width Massachusetts Modified Squirrel Cage Fans, because of their great capacity, extreme efficiency and economy of operation.

The services of our engineering department are at the disposal of any architect or builder whose plans include the installation or remodelling of a ventilating system.

Condensed Bulletin of Fans, Blowers, Heaters, etc. Sent Free on request.

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before the State utilities commission and secured an advance in its heating rates which raised the charges from two to three times what they were before the meters were installed. Continued complaints from the consumers led the company to make its announcement of the discontinuation of the service entirely.

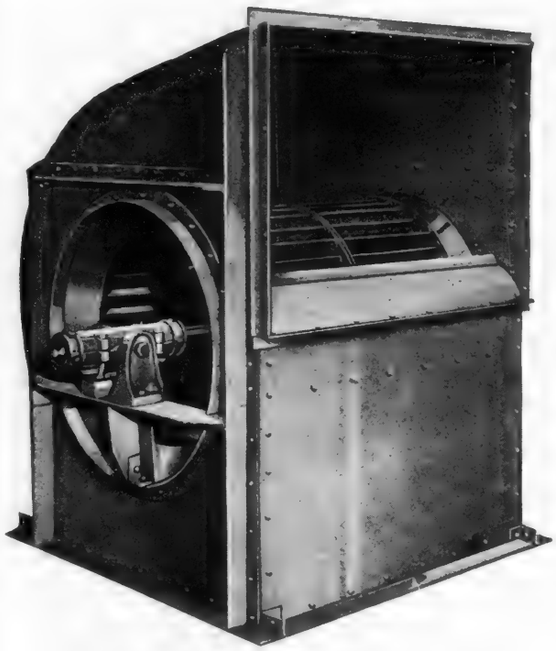
Kenosha, Wis.—An important solution has been proposed in Kenosha in connection with the problem confronting all users of heat supplied by the municipal heating plant of the Wisconsin Gas & Electric Company. It involves the adoption of a zone system, with the abolishment of all mains extending beyond a fixed number of blocks. This proposal has been made by twenty of the sixty citizens affected. R. P. Cavanagh, local attorney, suggested the zone system as the only feasible method of securing permanent heat and of stopping altercation between the consumers and the company. A committee was appointed to arrange a map which would be divided into three zones. One zone will include the downtown district and the other two will extend farther out. Attorney Cavanagh was authorized to confer with the railroad commission to ascertain what rates should be charged in each of these zones, providing that double the present number of subscribers could be secured. It is thought that a centrally-located group of users, with doubled consumption, would make it profitable to operate the plant and reestablish the mains. At the present time there are 61 users and it would be unprofitable to lay new mains under the present circumstances. The company has expressed a desire to abandon the service on the ground that it would cost $100,000 to re-establish the system in Kenosha so that it would give satisfaction to all.

New Firms and Business Changes.

Thatcher Heating Co., Akron, O., with offices at 46 South Broadway, has been organized by George S. Thatcher, formerly manager of the Industrial Heating & Engineering Co., Complete facilities and equipment have been obtained for the design and construction of heating and ventilating systems power plant piping and similar work. Mr. Thatcher is a member of the American Society of heating and ventilating engineers.

Dwight P. Robinson & Co., Inc., New York, is the new title of a combination of the organizations of Westinghouse, Church, Kerr & Co., Inc. engineers and constructors, and Dwight P. Robinson & Co., Inc., constructing and consulting engineers, both of New York. The combined company will occupy executive offices at 61 Broadway, and engineering and designing offices in the Grand Central Palace, 125 East 46th Street, New York. Dwight P. Robinson, president of the new company, was for many years president of the Stone & Webster Engineering Corporation and formed his own company in 1918. He has had an extended experience in the design and construction of industrial plants, central power stations and hydro-electric plants, and his company, the principals of which left Stone & Webster with him, has specialized in work of this nature. At the time of the merger, the Robinson company had large power plants under construction for the Duquesne Light Company, at Pittsburgh, the Penn Public Service Company, at Johnstown, Pa., and others. Westinghouse, Church, Kerr & Co., Inc., established 36 years ago, has specialized in the design and construction of industrial plants of all kinds, railroad shops and terminals, and industrial power plants. As the activities of the two companies were largely supplemental, it is believed that the new organization will become one of the largest and most successful in the construction and engineering business.

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is one of the largest stockholders of Westinghouse, Church, Kerr & Co. and these two companies have been closely identified for many years. General Guy E. Tripp, now chairman of the board of Westinghouse, Church, Kerr & Company, retains this position pending completion of the merger. The Westinghouse Electric company states that one of the reasons for the



Cut shows double width double inlet
SERI-VANE FAN TYPE C
full housed overhung pulley

Seri-Vane Fans

Write for our latest catalogue Number 70 describing our

Seri-Vane Fans Type C

A special SERI-VANE FAN is made just for that fan problem you have.

We specialize in complete installations for the drying of brick, lumber, powder, gelatine, glue, paper, leather, etc.

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CHICAGO, ILL.
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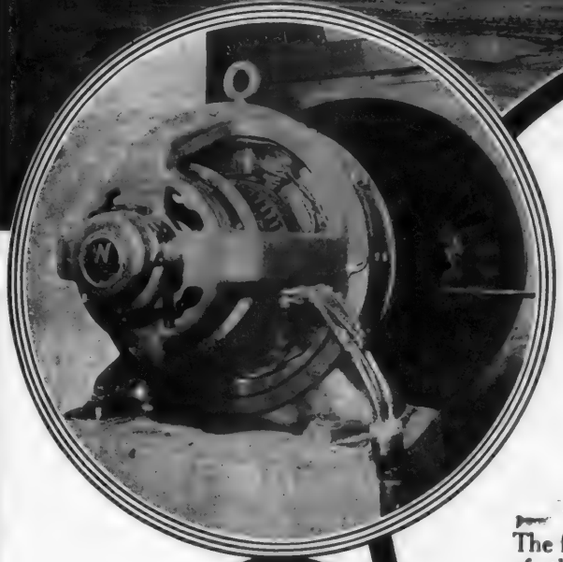
Branch offices in all large cities



It is Continuous Service That Counts

Westinghouse Ventilating Motors are driving practically every type of ventilating equipment—driving it efficiently and with unfailing regularity.

Westinghouse Ventilating Equipment is specified and installed by many reputable architects, builders, and heating and ventilating contractors.

The fact that Westinghouse Motors are operating in many of the largest buildings throughout the country is a guarantee of service.

Write our nearest district office for a copy of our ventilating circular No. 7193.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

Sales Offices in all Large American Cities

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WESTINGHOUSE ELECTRIC

Westinghouse

merger was the desire to avoid what has seemed a handicap in procuring business by Westinghouse, Church, Kerr & Company on account of the belief by prospective clients that if they employed the latter company as their construction engineer, they might be expected to purchase Westinghouse Electric equipment, and also to permit the Westinghouse Electric company to withdraw from any interst in the engineering and construction business, that being a field foreign to its normal activities, its interest therein not being viewed with favor by construction engineers competing with Westinghouse, Church, Kerr & Company. The announcement further states that in the organization of Dwight P. Robinson & Co., Inc., the Westinghouse Electric & Mfg. Company, Guy E. Tripp, and others became stockholders. The personnel of both organizations will be retained in the new company.

Central Plumbing & Heating Co., Park Falls, Wis., has been organized to take over the business of the Molter Plumbing & Heating Co. Mr. Molter retires from the business and the principals of the new company are A. R. Marson, George C. Beilke and Walter Baumgardt.

M. Abbott's Sons, New York, has recently been reorganized with Harold Pollack as president and treasurer and Philip H. Abbott as vice-president. This concern was founded in 1857 and has since been located at 137 Eighth Avenue. The business was incorporated in 1903. It will continue to handle engineers' supplies, hardware, pipe and fittings, sheet metal work, furnace and range work, in addition to its contracting business, in steam and water heating. Additional lines that will be taken on, after the enlargement of its shops is completed, will be electrical work, as well as elevator, motor and pump work.

New Incorporations.

Ford Regulator Corporation, New York, capital $175,000, to manufacture valves, regulators, etc. Incorporators: E. H. Bolton, T. A. Hardy and T. B. Ford, White Plains, N. Y.

Smith, Carvel & Co,. Portland, Me., capital $10,000, to engage in heating, plumbing and gas fitting work. President, Chipman J. Smith; treasurer, Harry Carvel; clerk, Max L. Pinansky.

Boig & Hill, Inc., New York, capital $30,000 to manufacture heating appliances. Incorporators: W. A. Boig, W. T. Hill and J. Mayer, 2358 Webster Ave., New York.

Michigan Oil Heating Co., Detroit, Mich., capital $50,000.

Rohr-Schank Oil Burner Corporation, Brooklyn, N. Y., capital stock $10,000, to manufacture oil burners and other heating specialties. Incorporators: S. P. Cohen, W. P. Lowe and J. E. Worthington, Jr.

Syracuse Vapor Heat Mfg. Co., Syracuse, N. Y., capital $40,000, to manufacture heating specialties. Incorporators: W. E. Woodcock, L. Paddock and W. D. Paddock.

Tremont Tool & Die Corporation, New York, capital $50,000, to manufacture steam fitters' tools. Incorporators: J. O. Humphrey, T. Hansen and V. K. Smith, 20 Broad St., New York.

Contracts Awarded.

Springfield, Ill.—Haas Electric Mfg. Co., Springfield, has been awarded the heating and plumbing contracts for the Illinois Centennial Building. The contract for installing the heating and ventilatng work amounts to $48,000 and that for the plumbing, $30,500.

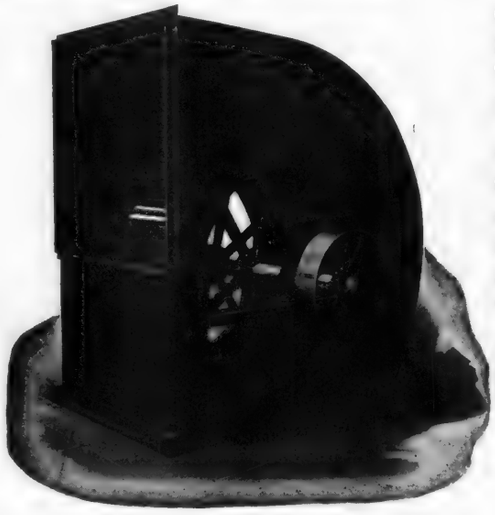
"Blue" Asbestos for the American Market.

In order to build up a reputation for blue-fiber asbestos in the United States, a new corporation, associated with the Cape Asbestos Company and known as Asbestos, Ltd., has recently been chartered under the laws of New Jersey. The company has opened offices at 8 West 40th Street, New York, and has acquired works at Bound Brook, N. J.

During 1915 and 1916 considerable "Cape Blue" asbestos was imported into the United States to supplement the Canadian and Arizona supply.

Buckeye Multiblade Fans

are made especially for low pressure Heating and Ventilating work. They are giving perfect satisfaction.



CORRECT DESIGN. HEAVY CONSTRUCTION, NOISELESS OPERATION, WORKMANLIKE FINISH, HIGHEST EFFICIENCY.

Our Engineering Department is maintained for the purpose of assisting Engineers, Architects, etc., in planning efficient Heating and Ventilating Systems for all buildings.

THIS DEPARTMENT IS FREE TO YOU.

We also manufacture a complete line of Disc, Cone and Steel Plate Fans.

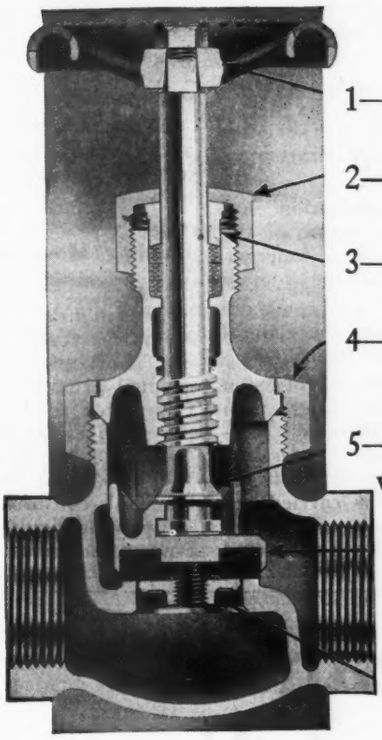
Write Department D

BUCKEYE BLOWER CO.

COLUMBUS OHIO.

SEVEN FEATURES OF THE CRANE NUMBER 7

for use in plants where continuous service is required and where discs must be changed quickly without injury to the valve.



1—Easily removable malleable iron, non-heat wheel

2—Malleable iron nut

3—Brass gland

4—Malleable iron nut

5—May be packed under pressure when valve is wide open

6—Removable disc holder for quick change

7—Removable nut for changing disc

Made in sizes ¼-to 2-inch; for 150 pounds steam working pressure; discs for steam, air and water supplied as ordered. Body, Bonnet, Stem, Disc Holder, Gland, made of Brass.

Fully described in Circular No. 128 which will be sent upon request.

We are distributors of heating and plumbing materials.

SALES OFFICES, WAREHOUSES AND SHOWROOMS:

BOSTON, SPRINGFIELD, BRIDGEPORT, ROCHESTER, NEW YORK, ALBANY, BROOKLYN, PHILADELPHIA, NEWARK, CAMDEN, BALTIMORE, WASHINGTON, SYRACUSE, BUFFALO, SAVANNAH, ATLANTA, KNOXVILLE, BIRMINGHAM, MEMPHIS, LITTLE ROCK, MUSKOGEE, TULSA, OKLAHOMA CITY, WICHITA, ST. LOUIS, KANSAS CITY, TERRE HAUTE, CINCINNATI, INDIANAPOLIS, DETROIT

FOUNDED BY R. T. CRANE, 1855

CRANE CO.

836 S. MICHIGAN AVE.

CHICAGO

WORKS: CHICAGO AND BRIDGEPORT

CHICAGO, ROCKFORD, OSHKOSH, GRAND RAPIDS, DAVENPORT, DES MOINES, OMAHA, SIOUX CITY, ST. PAUL, MINNEAPOLIS, DULUTH, FARGO, WATERTOWN, ABERDEEN, GREAT FALLS, BILLINGS, SPOKANE, SEATTLE, TACOMA, PORTLAND, POCATELLO, SALT LAKE CITY, OGDEN, SACRAMENTO, OAKLAND, SAN FRANCISCO, LOS ANGELES

CRANE LIMITED MONTREAL, TORONTO, VANCOUVER, WINNIPEG, LONDON, ENG., SYDNEY, N. S. W., QUEBEC, HALIFAX, OTTAWA, CALGARY.

The crude fiber was treated in the same way as Canadian fiber, but in general the product obtained was unsatisfactory. Similar results were obtained when blue asbestos was first used in Europe. In order to overcome the objections of manufacturers, the Cape Asbestos Co., of London, the largest producers of blue asbestos, established a spinning plant and demonstrated that the product is well suited for certain purposes, provided it is properly treated.

It is the purpose of the new American corporation to prepare all crude blue fiber for carding machines by a special process which, it is claimed, is more satisfactory than methods formerly employed in this country. The prepared fiber will be sold to manufacturers. While blue asbestos cannot be substituted for white fiber for all purposes, it is well adapted for certain uses, and its wider use would tend to relieve the present critical shortage of Canadian crude.

The foregoing information is furnished by the U. S. Bureau of Mines, in its Monthly Reports of Investigations.

Organization of Architectural Draftsmen.

Details of the movement which has resulted in the formation of an architectural draftsmen's union are given in the *Journal* of the American Institute of Architects. They show that the union is not only definitely established, but that the architects have become alive to the situation and have seen the necessity of co-operating with it. At a recent meeting of the New York Chapter of the Institute, the draftsmen's organization was invited to send a delegation to give information about the movement. This was done with the result that the architects appointed a committee of fifteen, five each from the New York Chapter of the American Institute, the Brooklyn Chapter, and the New York Society of Architects, to meet a committee of the draftsmen, so that a basis of co-operation might be arranged.

This group has met and organized a permanent committee of six architects, two from each of the societies just mentioned, and six draftsmen, members of the society.

The draftsmen's organization has been launched under the name of the Architectural Society of America. The general purposes of the society are stated to be:

Briefly the following are the general purposes of the organization:

1. To safeguard the profession against the inroads of other than bona-fide architects, thereby safeguarding the future of the profession.

(NOTE.—Approximately 98% of the architecture done today is carried out by others than bona-fide architects.)

2. To be a force to direct the trend of legislation that controls our profession in practice.

3. To eliminate the improper practices now existing in the architectural profession.

4. To maintain a standard of remuneration commensurate with economic condtions.

5. To formulate and maintain a standard of ethics for relationship between employees and employer.

6. To bring to the attention of the potential architect the qualifications which he must possess to practise the profession.

7. To bring to the lay mind a realization of the proper field and scope of the architect.

Are you interested in the future of the profession and your own future?

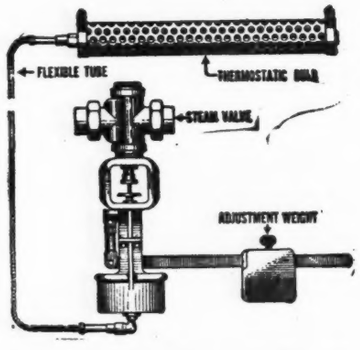
If you are, talk this over with your architectural friends and bring your ideas with you to a meeting to be held, etc.

Building Movement to Grow Slowly.

Present conditions indicate that a large building movement which now seems inevitable in view of the housing shortage must be of slow and gradual growth, the National Bank of Commerce in New York declares in the April number of its magazines, *Commerce Monthly*.

"The dearth of building supplies," the bank continues, "is rendered more acute by difficulties of transportation. Some time must elapse before the

Heat Saving Means Fuel Economy



The Powers Regulator No. 15

Specially designed to control temperatures in dry kilns, ovens, varnish and dry rooms, etc. Requires no outside power for its operation.

The place to begin practicing heat economy is at the *point of use*. This immediately brings about economy in the Boiler Room. Begin now to save the heat at the "point of use." Equip heating systems, hot water tanks (either open or closed) cooling systems, dry rooms, ovens, shower baths—any place where overheating is possible—with

Powers Heat Regulators

These accurate, dependable machines positively control the heat at the "point of use." Their economy is three fold.

They *save fuel* by using only necessary heat.

They *save labor* by releasing men who now attempt to control temperatures by hand.

They *save material and fixtures* by preventing overheating.

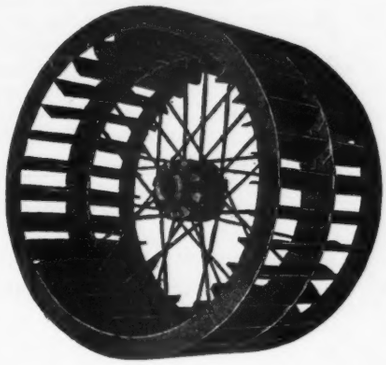
We have spent more than thirty years in studying temperature control in nearly all industries. Our close study and research work have given us a large fund of information which is cheerfully at your service. Consult us freely. Write today.

THE POWERS REGULATOR CO.

Specialists in Automatic Heat Control

954 Architect's Bldg., New York
365 The Federal Street Bldg., Boston
2718 Greenview Ave., Chicago
The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

(1231)



A Service That Helps You Serve

Bayley engineers are always ready to co-operate with you. When you have a problem of ventilating or indirect heating, write us. We'll submit plans and estimates for any buildings you are working on and explain the value of the

Bayley

Plexiform Fan

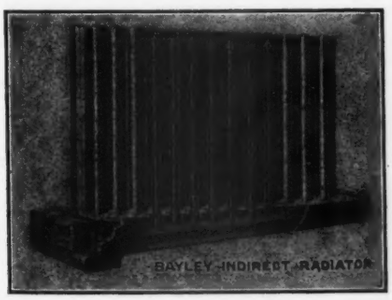
These fans operate equally well in single or double widths and provide maximum air delivery against low or medium high resistance, with the least amount of housing. Smooth, almost silent in operation. Very economical of power.

Bayley Chinook Heater

for indirect heating of plants of all kinds. Used in connection with the Bayley Plexiform Fan they are ideal equipment. Positive and constant circulation of steam is assured. Every square foot is prime heating surface.

Let our engineers consult with you on your specific problems. Or write for the Bayley Bulletins.

BAYLEY MANUFACTURING CO.
732 Greenbush St. Milwaukee, Wis.



Standard with STEAM USERS SINCE '94

"Steam Savers" That Do Save

Because they are guaranteed—

Because they are shipped on trial—

Because they must satisfy, before the sale is complete—Wright-Austin steam specialties are indorsed and recommended by thousands of our customers in every section of the country.

Let us send you complete information about our "steam savers," including steam and oil separators, strainers, pump governors, boiler feed regulators, safety water columns, steam traps, exhaust heads and grease traps.

And, if after giving one of our products a thorough trial—you are not satisfied—remember that it can be returned and we will pay the freight both ways.

Because it assures a constant flow of dry steam, the Wright-"Emergency" Trap has been found invaluable for increasing the efficiency of heating equipment.

Large or small quantities of condensation under absolutely no pressure—and up to 20 pounds—are discharged through one large valve by the "Victor" Trap.

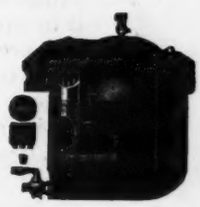
Let us send the Wright-Austin Catalog to you. It has pages on traps and their operation.

Wright-Austin Company

76 Woodbridge Street
DETROIT MICHIGAN

Branch Offices:
New York Atlanta Chicago Boston
Representatives Everywhere

Wright "Victor" Trap



Wright "Emergency" Trap

various lines of industry which furnish these materials will be able to function at full capacity. Added to this is the difficulty, under present conditions, of financing new enterprises."

Manufacture of Asbestos Pipes.

Pipe made of asbestos and capable of bearing a maximum pressure of 450 lbs. per square inch is now being manufactured in Italy, according to a statement of the Bureau of Mines. The manufacturer is the Eternit Pietro Artificiali, of Genoa. The pipe, which is composed of 85% Portland cement and 15% asbestos fibre, is made in various sizes from 4 in. to 12 in. in diameter, and in lengths up to 12 ft. The thickness increases with the size from about ½-in. for the 4-in. pipe to about 15/16-in. for the 12-in. size. The pipe is seasoned under water for 90 days.

Asbestos pipe is much lighter in weight than iron pipe and is said to be acid and corrosion proof. The cost of manufacture is comparatively low.

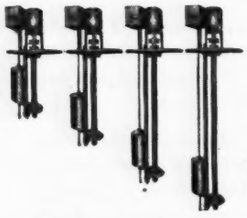
Reinvest Liberty Bond Interest Money.

The Government Loan Organization is recommending the re-investment in Government Savings Stamps of the $43,454,162 of interest due April 15, on the Fourth Liberty Loan Bonds. Immediate investment on Government Savings Stamps will mean that every person who spends $4.15 this month for a Government Savings Stamp, will have that sum of money earning one cent per month thereafter and will get from the government $5.00 in January, 1925. Arrangements have been made for the acceptance of the coupons at post-offices and banks, as direct payment in lieu of currency.

WANTED

Wanted—Draftsman, for steam heating and ventilating work. State age, experience and salary desired. Headquarters in Oklahoma. Address Oklahoma, care of Heating and Ventilating Magazine.

WET CELLARS - ABSOLUTELY - MADE DRY



Electric Automatic Cellar Drainers

NOW IS THE TIME when cellars and basements often become wet and damp. They can be made Useful and Bone Dry by using Economy Automatic Electric Cellar Draines for smaller and Fig. 2104 Bilge Pumps for larger work. Made in sizes of ten gallons to 2500 gallons per minute.

BE A SPECIALIST. Study this subject and reap a financial reward by supplying these devices to your troubled customers. Premises in flooding dislricts need have no fear when supplied with Economy Pumps.

Made of highest quality materials. Absolutely automatic and dependable. Quantity production secures Lowest Prices.

Condensation—Return and Air Line Vacuum Pumps. Centrifugal Pumps.

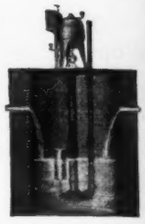
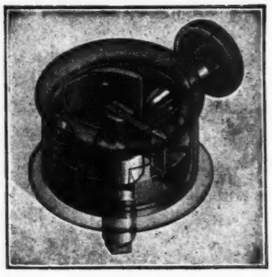


Fig. 2104 Bilge Pump

ECONOMY PUMPING MACHINERY CO., 120-126 No. Curtis St., Chicago, Ill.



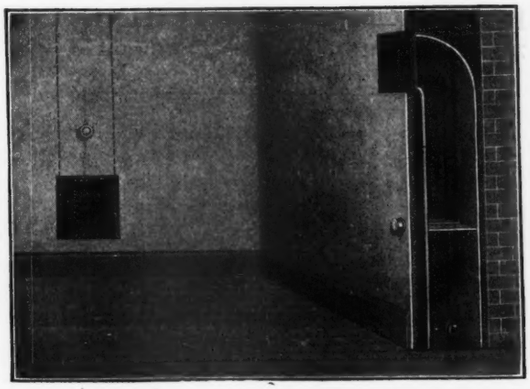
Perfecto Damper Regulator and Indicator

Positively regulates the supply of hot or tempered air in heating and ventilating systems.

The Perfecto Damper Regulator and Indicator shows the position of the damper in the pipe and is provided with lettered or numbered cover windows to correspond with the rooms to which the various pipes lead.

The Perfecto Damper Regulator and Indicator effectively prevents any unauthorized person from tampering with the temperature control adjustment.

The Perfecto Damper Regulator and Indicator may be placed on the wall of a room where the ventilating ducts are concealed within the wall and the damper connected to it by an extension of the square damper rod. This arrangement is especially useful in school rooms to control the inflow of tempered air and exhaust of vitiated air. When the damper is set by the engineer or janitor it cannot be altered by anyone except the person in charge of the heating and ventilating system.



THE SIXTH CITY SHEET METAL WORKS CO.
Cleveland, Ohio